DOCUMENT RESUME

ED 356 967 SE 053 456

TITLE	All "Trashed" Out: An Activity Guide to Solid Waste Management for Grades K-6.
INSTITUTION	Illinois Univ., Springfield. Center for Solid Waste Management and Research, Springfield.
SPONS AGENCY	Illinois State Dept. of Energy and Natural Resources, Springfield.
REPORT NO	ILEN/RR-92/02
PUB DATE	Feb 92
CONTRACT	SWR-2
NOTE	74p.
AVAILABLE FROM	Illinois Department of Energy and Natural Resources, ENR Clearinghouse, 325 W. Adams Street, Room 300, Springfield, IL 62704-1892.
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	*Class Activities; *Consumer Education; Elementary Education; Environmental Education; Instructional Materials; Learning Activities; Lesson Plans; *Recycling; Science Education; *Solid Wastes; Teaching Methods; Units of Study; Values; Waste Disposal
IDENTIFIERS	Environmental Impact; *Environmental Issues; Illinois; Packaging; Social Impact

ABSTRACT

This activity guide, specifically designed for Illinois classrooms but adaptable for other states, seeks to encourage primary students to make their own personal statement and responses to the environment through increased awareness of reducing, reusing, recycling, and composting of solid waste materials. The activities incorporate environmental topics related to solid waste management in an integrated approach for math, science, and social studies. For each lesson plan the time needed, objectives, corresponding state goals, background information, materials, preparation, procedure, extension activities, and evaluation techniques are specified. Sources used to develop the activities are listed at the end of each activity. An annotated list of supplemental resources and a glossary of terms that can be used as vocabulary words are included in back of the book. (Author/MCO)

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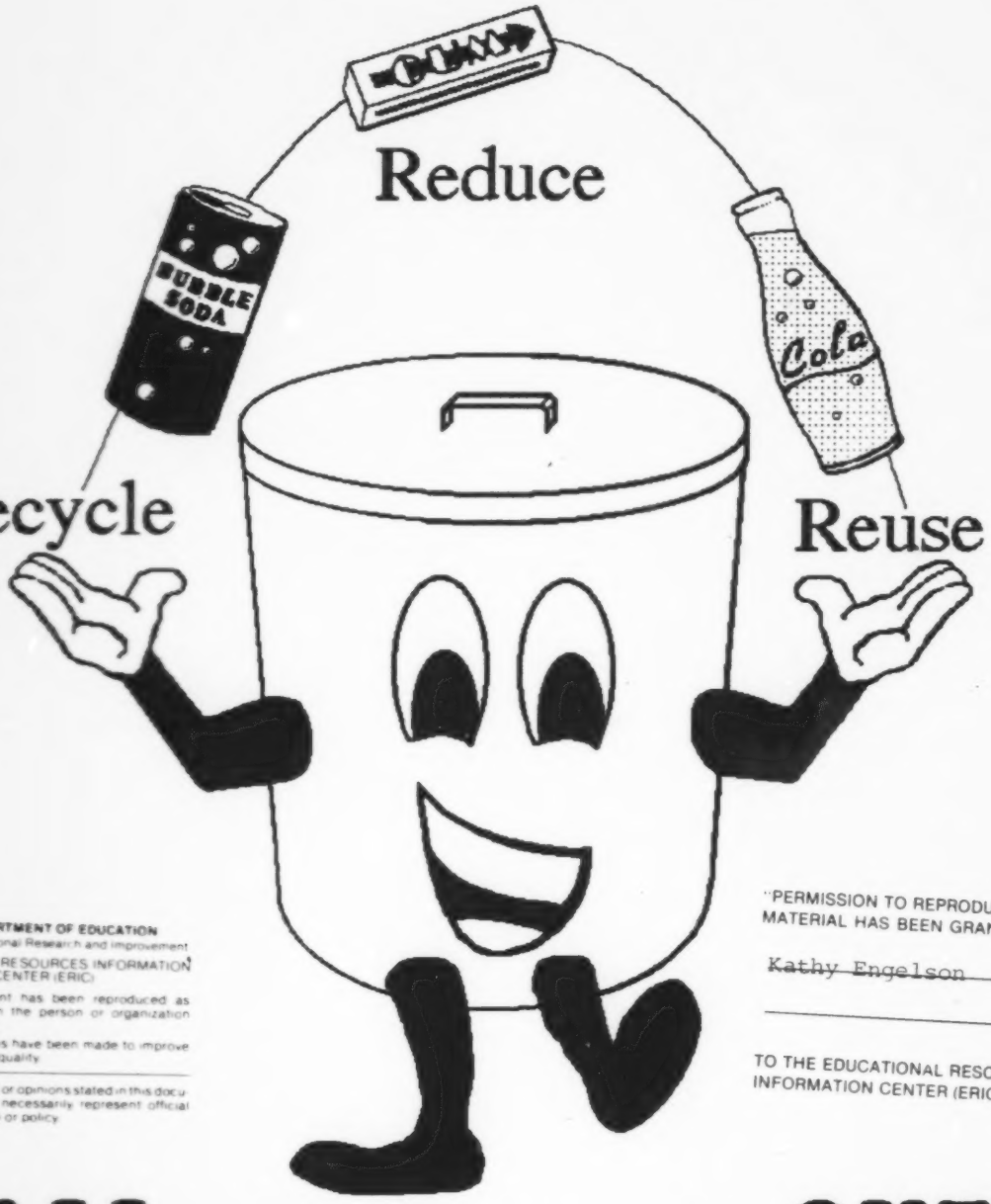

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ALL "TRASHED" OUT

Grades K - 6

ENR
Illinois Department of Energy and Natural Resources

REDUCE-REUSE-RECYCLE
Office of Recycling and Waste Reduction

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Many individuals not specifically named here contributed personally to the success of this project. We extend our sincere appreciation to them.

University of Illinois
Center for Solid Waste Management and Research, 1991
Funded by Grant No. SWR-2

Illinois Department of Energy and Natural Resources
Office of Recycling and Waste Reduction
Springfield, Illinois 62704-1892

This document has been reviewed by the Illinois Department of Energy and Natural Resources (ENR) and approved for publication. Statements made by the authors may or may not represent the views of the Department. Additional copies of this document are available through the ENR Clearinghouse at 1-800-252-8955. TDD customers may call 1-800-526-0844.

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INTRODUCTION

Science is one of the most exciting and motivating school subjects for primary children. It is th **process** of asking questions and finding answers to the questions about the world thr observations and experimentation. **ALL "TRASHED" OUT** is an educational hands-on progr designed for primary-age children. It involves them in activities dealing with solid waste manage and helps children discover more about the world around them.

ALL "TRASHED" OUT will encourage primary students to make their own personal statemer and responses to the environment through increased awareness of reducing, reusing, recyclir and/or composting of solid waste materials. The activities offer easy ways to incorporate environmental topics—integrating math, science, and social studies. **ALL "TRASHED" OUT** not only provides ways for students to learn about the environment, but it also encourages the to become actively involved in making decisions that will affect their future.

It is increasingly evident that we face a solid waste crisis. Today's youth should be made awa of the importance of our environmental resources and of the impact of man's dependency on relationship to the environment. By using the suggested activities in this activity book, you can challenge and stimulate your students' interest in science and help them learn to respect the planet they will inherit.

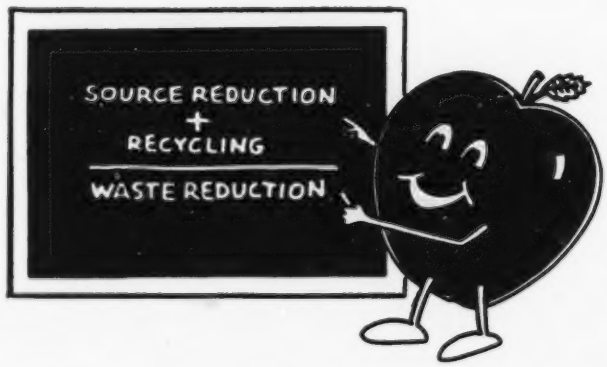
OVERVIEW

This activity guide will assist you in teaching the topic of solid waste management. The materials and supplies necessary to teach all of the activities in this packet are listed at the beginning of the guide. These materials are easily obtainable. Consumable materials are indicated with an asterisk.

Activity objectives are listed at the beginning of each activity. These objectives are related to the State Goals for Learning in Science, Math and Social Studies. These goals identify what students are expected to know by the time they complete their elementary education. For your reference, the text of the state goals for learning in science, mathematics and social studies is reproduced at the end of this guide.

Teacher background information will provide facts and figures to assist in the teaching of each activity. Since this information is written to assist the teacher in his/her understanding of the underlying concepts being developed, many terms are included that may or may not be suitable for the primary student. The teacher knows best how much or how little information his/her class requires in order to understand the underlying concept of each activity.

Also included with each activity are ideas for student evaluation and suggestions for extension activities. Sources used to develop these activities are listed at the end of each activity. In addition, an annotated list of supplemental resources and a glossary of terms that can be used as vocabulary words are included in the back of the book.



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MATERIALS AND SUPPLIES

Materials	Amount
To complete the activities in this guide, you will need:	
*Aluminum foil	25 feet
Aluminum pan, 9" x 13", 3" deep	1
Aquarium, plastic, 1-gallon, or plastic shoe boxes	6
Buttons, plastic	6
*Cardboard	several pieces
*Charcoal	1 box
*Cellophane tape	1 roll
Cotton cloth, 1/4 yard	1
*Garden soil	40 lb.
*Garbage bags, 30-gallon	3
*Gravel	1 lb.
*Gum, 1 package each, 6 brands	6
Marbles	6
Masking tape	1 roll
Measuring cup, plastic	1
*Milk cartons, 1-gallon	6
Paper clips	1 box
*Paper cups	10
Paper lunch bags	40
Pencils	each class member
*Plastic cups, 8 oz.	30
*Plastic wrap	1 roll
Popsicle sticks	6
*Potting soil, 5 lbs.	1 bag
Rolling pin	1
Rubber bands	1 box
*Sand,1 lb.	1 bag
Thermometers	6
Tongue depressors	6
Window screen, 7" x 11"	2 pieces
Wire strainer	1

TEACHER-SUPPLIED — Have this equipment available:

Blender
Cardboard boxes (5 large)
Crayons/markers
Glue
Newspaper
Paint
Nurse's scale or Bathroom scale
Pan balances or Triple-beam balances
Paper
Metric rulers
Scissors
Measuring cup
Water
Rolling pin

*These items may need to be replaced after completing the activities in this guide.

ACTIVITY 1

THE 3 R'S—REDUCE, REUSE, RECYCLE

Time: Two 45-minute class periods

Objectives:

Students will:

- identify **reducing**, **reusing**, and **recycling** trash as solutions to the solid waste problem.
- identify household practices that relate to the **3 R's** and state ways in which they can help to limit waste.
- describe basic **recycling** practices.
- demonstrate how to sort trash for **recycling**.

State Goals - Knowledge/Skills Correlation:

Science:	I - D II - E, G III - A IV - A, B, F, G	**Social Sciences:**	I - B, O II - F III - F IV - F, J V - A, M	**Math:**	I - D

Background Information:

When we throw away garbage, it usually ends up in a landfill. But landfill space is getting increasingly scarce. By the mid-1990s, most Illinois landfills will be full.

On the average, Americans throw away seven pounds of garbage every day. In 1990 alone, it is estimated that Americans will have thrown away 1 million tons of aluminum cans and foil, more than 11 million tons of glass bottles and jars, over 4.5 million tons of office paper, and nearly 10 million tons of newspaper. Most of the garbage can be recycled. In fact, nearly 50 percent to 80 percent of all garbage is recyclable. Yet, in Illinois, we recycle only 6 percent of our garbage.

The solid waste problem is a serious one. To assist students in their studies, introduce them to the **3 R's - Reduce, Reuse, and Recycle**. This phrase and simple terms will remind students how they can help reduce the garbage crisis. Even in the primary grades, students can be introduced to possible ways to reduce and reuse, and to the possible materials that can be recycled.

1. **Reducing** - decreasing the amount of waste entering the waste stream.
2. **Reusing** - using items for one purpose, then putting them to use for another purpose.
3. **Recycling** - the process of making new things out of old items.

Reducing the amount of garbage that must be thrown away **BEFORE** it becomes garbage will help eliminate the garbage crisis. This generally occurs at the grocery store. Choosing least-waste packaging and large-volume products reduces the amount of garbage that eventual will be thrown away.

Reusing items more than once also will help eliminate the garbage crisis. Items, such as two-liter plastic bottles, can be reused in many ways.

Recycling saves energy. Recycling one glass jar saves enough energy to light a 100-watt light bulb for four hours. Recycling an aluminum can results in 95 percent less air pollution and 97 percent less water pollution than creating an aluminum can from raw materials. Manufacturin new paper products from waste paper uses at least one-third less energy and cuts air pollution b 74 percent compared to making paper from wood pulp. The energy saved by recycling one glass bottle could run your television set for three hours. Recycling one 12-ounce aluminum can save 6 ounces of oil.

Materials:

Student trash items	5 large bags or boxes
Teacher trash items	1 large plastic trash bag

Preparation: (2-3 days prior to lesson)

Prior to the lesson, ask students to bring in two clean trash items from home (excluding food wastes.) Additional items provided by the teacher will ensure that there is a variety of items in each category. Suggested items include:

1. those that can be **reused**, such as paper and plastic grocery bags, aluminum foil, and two-liter plastic bottles.
2. those that can be **recycled**, such as newspaper, aluminum cans, plastic milk jugs.
3. those that cannot be recycled or reused, but can be **reduced**, such as overpackaged products (items with excessive packaging or unnecessary packaging).

Five large bags or boxes for sorting trash and one "class trash bag" will be needed. Label the bags or boxes as follows: GLASS, PAPER, ALUMINUM, PLASTIC, LANDFILL BOUND, and CLASS TRASH BAG.

Procedure:

1. Place the trash items into a large "class trash bag."

2. Hold up each item and ask questions such as:

   - What was this item used for?
   - Could this be found in your trash at home?
   - Why is this being thrown away?
   - What happens to this trash after it leaves your home?
   - Why should we be concerned about this trash?
   - What is this item made of?

3. Tell students that, in order to reduce the amount of garbage we produce, some of the items can be used again, some can be used for other purposes, and some need not be bought in the first place. Introduce the **3 R's**.

4. Have students brainstorm ways these items could be **reduced**, **reused**, or **recycled**. Use the following questions to motivate the discussion:

   - Which items are found in most of our homes?
   - Are any of these items used again in our homes? If so, for what?
   - Why is it important to reduce the amount of garbage in your home?
   - Where will this trash go after you throw it away?
   - What does it mean to recycle? What materials can be recycled?
   - What difference does it make if we do or do not recycle?
   - Where is the nearest recycling place? Has anyone been there? What items did you take to it?

5. Place students in pairs. Display the five labeled bags/boxes you prepared earlier. Explain to the students that the first four containers will hold items that can be recycled. Let students take three or four items out of the "class trash bag," two students at a time, and place the item in the appropriate container for recycling. Notice that some of the items remain and cannot be recycled. They may end up in the "landfill bound" bag unless students can name alternatives to replace these items. While students are sorting the trash, they can also decide if items can be reused before recycling. Please note that while we can decrease the volume of trash, some items will still end up in a landfill.

6. Discuss local availability for recycling these items and the rules that may apply for each category. Newspaper must be separated from other paper products. Glass must be sorted by color. Aluminum includes cans, TV dinner trays, pie plates, and foil. Plastic may be limited to milk jugs and two-liter soda containers. Check the bottom of plastic containers for recycling code numbers that help identify each plastic type. **CHECK TO SEE WHAT IS RECYCLED IN YOUR AREA.**

Plastic Container Code System For Plastic Bottles			
	CODE	**MATERIAL**	**TYPICAL PRODUCTS**
	PETE	Polyethylene terephthalate (PET)	soft drink bottles
	HDPE	High-density polyethylene	milk jugs, laundry detergent
	V	Vinyl/polyvinyl chloride (PVC)	vegetable oil bottles
	LDPE	Low-density polyethylene	dry cleaning and bread bags
	PP	Polypropylene	yogurt cups
	PS	Polystyrene	carry-out containers
	Other	All other resins and layered multimaterial	microwavable serving ware

7. Encourage students to share what they have learned about the **3 R's** with their parents.

Evaluation:

Students will be evaluated:

— through teacher observation of participation in the class discussion of the **3 R's**.

— by observing the proper sorting of trash for recycling.

— by completion of a poster depicting solid waste and the ways in which they can personally help **reduce**, **reuse**, and **recycle**.

Suggested Extensions:

1. Have an exhibit day when students can share items made from recycled materials.

2. Students can make an information sheet to take home to share with their parents. On th sheet, students will list ways to reduce, reuse, and recycle. Each student can choose tw ways that s/he can help decrease solid waste. Emphasize to the students that the choice should be based only on things that they are actually going to do. They should enlist the help of their parents. The following day, students can share their discussion with the cla

3. **Trash-Bag Game:**

   Hand one trash item to each student, then have all students stand together in a group representing one large trash bag. The teacher is the trash collector who will take away the trash. Describe what happens at a landfill and ask if anyone really wants to go there! If not, they can be rescued by thinking of a way they can be reused or recycled. Try to save all the trash (students). Discuss ways to redesign products that cannot be recycled or reused. Discuss what happens if there is no more room in the landfills.

4. Visit a recycling center.

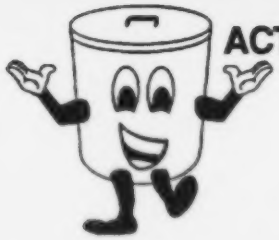
Sources:

Holm, D. Andrew. (Revised) Plastics In Perspective. Illinois Department of Energy and Natural Resources, Springfield, Illinois, 1991.

National Wildlife Federation. Earth Day, Every Day poster, Washington, D.C., 1990.

Wiziecki, Edee Norman et. al. Solid Waste: From Problems to Solutions. Illinois Department of Energy and Natural Resources, Springfield, Illinois, 1990.

Note the video, Reduce, Reuse, Recycle: It's Elementary, listed in the supplemental resource section.



ACTIVITY 2

USEFUL TRASH?

Time: One 45-minute class period

Objectives:

The students will:

- identify and describe waste material from their own trash.
- distinguish between trash items that are useful waste (can be reused or recycled) and nonuseful waste (must be thrown away.)

State Goals - Knowledge/Skills Correlation:

Science:	I - I II - G, C, E, F III - B IV - A, B, F, G	**Social Sciences:**	II - F III - F IV - F, J V - C	**Math:**	I - A, D

Materials:

Group items listed below
Copies of the data sheet

Preparation: (2-3 days prior to lesson)

Provide students with or assign students to bring the following items to class so that **each group** has one of each item.

plastic soda bottles	tin cans
aluminum cans	pieces of rope
glass bottles	orange peels
newspapers	bottle caps
paper grocery bags	

Provide two additional items—cigarette butts and empty spray cans. Due to safety precautions, the students should **not** be asked to bring these items from home. During the lesson, the safety factors involved in using these two items should be stressed.

Procedure:

1. Explain to the students that most objects are useful at one time. When we no longer need them, grow tired of them, or they break, these waste objects usually end up as trash. But sometimes these items can be used again.

2. Tell students that they are going to be given several objects that need to be classified as "more useful" or "less useful."

3. Arrange students in groups of five and give each group a bag with the items in it.

4. Each group should rate the items on its data sheet and indicate why the group put the object in the "more useful" or "less useful" category. Useful trash can generally be reused or recycled. Trash that is "less useful" cannot easily be used for other items or cannot easily be recycled.

5. When students are finished (allow 15-20 minutes), discuss the concepts of reuse and recycling. Explain that some objects, which are thrown away, could be reused - - used for a different purpose, or recycled - - taken to a recycling center where they are remade into new objects. Have each group share its ideas and classifications with the class.

6. Go over each item as a class and discuss whether the item can be recycled, reused, or if it is just "landfill bound." Many items on this list, such as bottle caps or rope, have no definite answer because some may be reused in art projects. The orange peel can be recycled in a compost.

7. Discuss the safety hazards presented by some of the items, such as spray cans and cigarette butts. Where do these trash items go? What can be done to solve the problems caused by these items?

8. The main idea of this activity is to get students thinking about what they throw away. They should ask themselves, "Can I reuse this for something else?" or "Can this be recycled into something new?"

9. Reinforce information about area recycling centers and discuss with students how they can help by participating in recycling in school and encouraging their parents to do so at home.

Note the Directory of Illinois Recycling Centers, listed in the supplemental resource section.

Evaluation:

Students will be evaluated:

— on their ability to work with others and participate in the classroom discussion as observed by the teacher.

— on completion of their data sheet observations.

Suggested Extensions:

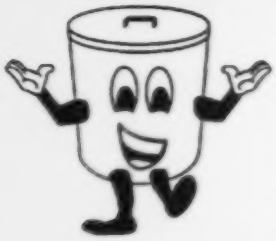
1. Save the clean trash items for use in other lessons or have groups create a useful "new" item out of one of the trash items.

2. Students could make their own poems about a waste item in the lesson or about useful and useless waste.

Sources:

Rogers, Diana (Columbus Clean Community-Columbus, OH) and George Peters (DLPR). Useful Waste, Ohio Department of Natural Resources, 1988.

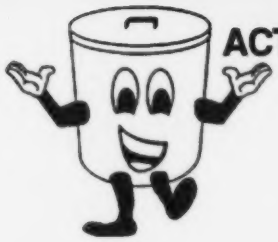
We throw away over 200 million tires every year
(one for every person in the United States).



ACTIVITY #2
USEFUL TRASH?
DATA SHEET

Rate each item as "more useful" or "less useful" by placing an "X" in the appropriate box. Give a reason for your choice.

ITEM NAME	MORE USEFUL	LESS USEFUL	REASON FOR YOUR CHOICE



ACTIVITY 3

"CLASS"-Y TRASH

Time: One 45-minute class period

Objectives:

Students will:

- identify ways in which the volume of classroom trash produced in one day could be reduced, reused, or recycled.
- weigh classroom trash for one day.
- calculate the weight of classroom trash for one week, month, and year.

State Goals - Knowledge/Skills Correlation:

Science:	I - D, I II - G III - A, B IV - A, E, F, G, M	**Social Sciences:**	I - B, E III - F IV - C, F, G V - A, C, H	**Math:**	I - B, E III - A, E

Background Information:

All over America, communities are having problems disposing of their trash. When the garbage hauler picks up the trash, it doesn't miraculously disappear. The garbage usually goes to a land fill. Our throw-away philosophy generates a tremendous amount of waste every year, and we are running out of places to put it. Evidence of our waste appears not only in our garbage cans, but also as trash along roads and in our neighborhoods.

Solid waste is any solid material we throw away that has no useful purpose in its present form. Often this waste could be reduced, reused, or recycled. The amount of solid waste is rapidly increasing due to population growth and our current "throw-away" life styles. This activity helps students visualize the volume of trash being thrown away daily by a typical elementary classroom.

Materials:

2 large cardboard boxes
2 large plastic garbage bags
Newspaper
1 bathroom scale
Copies of the data sheet

Preparation: (10-15 minutes)

Two large cardboard boxes for collection bins, old newspapers, and a bathroom scale (or the scale from the nurse's office) will be needed for this activity. Arrangements should be made for trash removal after the lesson.

Procedure:

1. Place a collection bin lined with a plastic garbage bag in the school cafeteria. Have your class place all of its trash, **excluding** food wastes, into the bin. (This is for your class only.)

2. Place another collection bin lined with a garbage bag in the classroom for students to place paper wastes for the day.

3. Weigh the total trash collected in one day. Remove the garbage bags from the box to record the **weight** of the trash. First record the weight of one student on the scale. Then record the weight again with the student holding one trash bag and then the other. Subtract the weight of the student to get the weight of each trash bag. Record this information on the data sheet. Find the total weight of the trash by adding the data from both bins.

4. Spread newspaper to protect the floor and empty each bag onto the newspaper. Sort the trash in two piles: **reuse** and **recycle**. (If time allows, further separate recyclables into paper, glass, aluminum, and plastic.)

5. Place what is left into a garbage bag and put it into a collection bin. Weigh the remaining trash. Record all information on the data sheet.

6. Compare the weight totals. How much was the trash reduced by removing recyclables and reusables?

7. Discuss ways to reuse materials and ways to reduce the amount of material discarded. Think of alternative packaging that might generate less waste.

8. Calculate the total amount of waste **by weight** for one week by multiplying the total weight for one day by five. Younger students can find the total weight for one week by adding the amount for five days (use the total weight for one day for each day of the week.) Enter the number on the data sheet. How much space would be needed for that much trash? Multiply the weight of trash for a week by four to find the weight of classroom trash for one month. Enter that number on data sheet. Multiply that number by nine to find the weight of classroom trash for one school year.

9. By recycling just the clean paper wastes from the classroom, how much trash could be saved from the landfill in a week, month, and school year?

Some statistics to share with students:

- Americans could fill two Superdomes with the garbage we throw away every day.
- Americans throw away 18 billion disposable diapers each year. Placed end-to-end, they could reach back and forth to the moon seven times.
- Each year, some leading fast-food restaurant chains use enough foam packaging to cover Washington, D.C., with a layer of trash a foot deep.
- It takes more than 500,000 trees to make the newspapers Americans read in one Sunday.
- Every 20 minutes Americans dump enough cars into junkyards to form a stack as high as the Empire State Building.

Evaluation:

Students will be evaluated:

— on cooperation in weighing the trash.

— on completion of their calculations on the data sheet.

— by listing every item they throw away for one day.

Once the list is complete, have the students circle all the items they think could have been reused or recycled. Working in teams of two or three students, have them answer the following questions:

- How could you reuse the items you circled?
- Which items are difficult to reuse or recycle?
- How does the practice of reuse and recycling affect our landfills?

Suggested Extensions:

1. Have students find other objects or materials in the classroom that could be reused or recycled and saved from the landfill.

2. Ask students to infer what would happen if the trash collectors stopped picking up the trash from the school or from the students' homes.

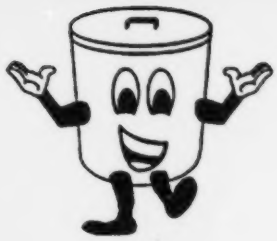
3. If possible, arrange to have a class pen pal from another country. Ask him/her what happens to trash in his/her country.

4. Find out the approximate size of your local landfill. Have students measure the playground area and calculate how many playgrounds could be placed on top of your local landfill. Note that many Illinois landfills will be full by the mid-1990s. Ask students how old they will be in 1995. What are they doing today about the solid waste problem? What more should be done?

Sources:

Landis, David (DLPR). It All Begins at Home, Ohio Department of Natural Resources, 1988.

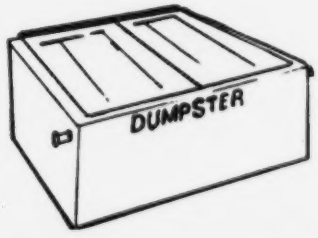
National Wildlife Federation. Earth Day, Every Day poster, Washington, D.C., 1990.



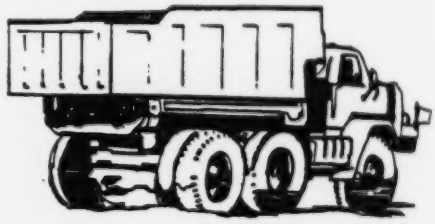
ACTIVITY #3
"CLASS"-Y TRASH
DATA SHEET

CAFETERIA TRASH	+	CLASSROOM TRASH	=	
_____ WEIGHT OF TRASH		_____ WEIGHT OF TRASH		_____ TOTAL WEIGHT OF TRASH FOR ONE DAY:

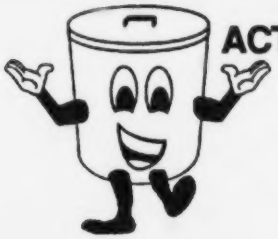
x 5 = WEIGHT OF TRASH FOR ONE WEEK: _____



x 4 = WEIGHT OF TRASH FOR ONE MONTH: _____



x 9 = WEIGHT OF TRASH FOR ONE SCHOOL YEAR: _____



ACTIVITY 4

WHAT'S THE WRAP?

Time: One 45-minute class period

Objectives:

The students will:

- classify different types of packaging according to its ability to be recycled.
- describe different reasons for packaging products.
- identify packaging that is unnecessary and recognize alternatives.

State Goals - Knowledge/Skills Correlation:

Science:	I - D II - B, E, G III - A, B IV - A, B, F, G	**Social Sciences:**	I - O II - F III - F IV - F, J V - A, D, C	**Math:**	I - D III - A, E

Background Information:

Excess packaging is causing a major problem in the management of solid waste. In order to find solutions to the packaging problem, it is necessary to identify the different types of packaging and the various reasons for them.

There are three main types of packaging. **Natural** packaging can be found in nature and is biodegradable. This includes corn husks and peanut shells. **Man-made** packaging falls into two categories. The first is packaging that is **easily recyclable or reusable**. The second is **excess** packaging that is often unnecessary and nonrecyclable.

The reasons for packaging vary. Some packaging is needed for health purposes to protect or preserve what is inside the package. Certain packaging prevent product tampering. Very often, however, excess packaging is used only to enhance the selling power of the product, for convenience, or to make the product look larger than it is.

In this activity, students observe and classify a variety of product packaging. They will identify alternatives to consuming and producing unnecessary packaging.

Materials:
Different types of packaging (supplied by students)
Different types of packaging (teacher examples)
A balance to measure the weight of the packaging

Preparation: (3-4 days prior to lesson)

Have students bring in several types of packaging that they have saved from the trash. A good time to gather these materials is soon after a trip to the grocery store or department store. Packaging should be clean. Examples of different packaging types may be provided by the teacher to assure a variety.

Procedure:

1. Discuss the three types of packaging and present at least one example of each to the class.

   a. **Natural Packaging**—nut shell, orange peel, banana peel. If composted, these biodegradable items can be turned into an organic humus that will enrich our soil.

   b. **Man-Made Packaging (reduce/reuse)**—clay pot, paper sack, glass bottle, cans, some plastics. These items can either be recycled or used for another purpose.

   c. **Man-Made Packaging (unnecessary or excess)**—toy packaging, polystyrene (styrofoam) packaging pieces. Many of these man-made packagings can be sorted and recycled or disposed of in a landfill. However, redesigning packages will eliminate this excess waste before it enters the waste stream.

2. Divide students into groups of five and have them classify the packaging they brought to school into the three categories discussed earlier:

   a. from nature
   b. easy to recycle
   c. difficult to recycle or nonrecyclable

   Which category had the most packaging? (Students can weigh each category and compare them).

3. Discuss the following information:

   - Much of our daily trash comes from packaging.
   - Natural resources and energy are needed to make unnecessary packaging. Help students identify the type of natural resource used to make the packaging (paper from trees, plastic from petroleum, glass from sand.)
   - Talk about **necessary** reasons for packaging (to keep things clean, to protect our health, to preserve what is in the package, for informational purposes).
   - Note the many **unnecessary** reasons for packaging (advertising, double packaging for looks.)

4. In order to save natural resources and avoid excess trash, people must make wise choices when buying products and consider a product's packaging when making a purchase. Let students create a list of things to remember when purchasing products.

   a. Don't buy unnecessary packaging—e.g., toys in plastic with cardboard around them, socks or shirts in a plastic bag, fruit wrapped in plastic, mini-lunches from the grocery store.
   b. Buy refillable or recyclable containers—e.g., returnable glass, aluminum cans, soda bottles, plastics that can be recycled.
   c. Purchase items that can be reused—e.g., cloth grocery bags, cloth diapers, refillable plastic beverage containers and mugs.
   d. If packaging is necessary look for those made from recycled materials. Look for the recycling symbol:

   e. Large-volume purchases are often wiser than frequent smaller-volume purchases. Larger-volume purchases leave only one container of waste and often are more economical—e.g., giant-sized laundry detergent or cereal boxes, refillable fabric softener.

Evaluation:

Students will be evaluated:

— on their ability to work with others and participate in the classroom discussion as observed by the teacher.

— on completion of their data sheet observations.

Suggested Extensions:

1. Create a bulletin board. Give students pictures and advertisements from a magazine. Have each student cut out a picture of a natural, recyclable, or hard to recycle packaging. Divide the bulletin board into these three topic areas. Have each student place their picture in the appropriate area. Let each student give reasons for his/her choice and explain if alternative packaging might be wise. As a class, discuss the pros and cons of each choice. There may be more than one appropriate category.

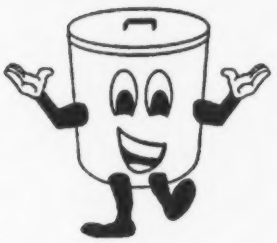
2. Have students draw pictures of the three types of packaging discussed - natural, recyclable, and hard to recycle. Each student may share his/her illustrations and reasons with the class.

3. Discuss with students that packaging accounts for about 15-50% of the cost of a product. Packaging also accounts for 40-50% of all consumer waste. Ask each student to choose three of the collected packaging items and decide if the packaging is excessive, if it is made from recycled materials, if it is recyclable, or if it simply must be thrown away. Develop a class list of tips to reduce the amount of packaging in the items people purchase.

Sources:

Barr, Gerda. To Buy or Not To Buy, Ohio Department of Natural Resources, 1988.

Landis, David(DLPR). Natural Resources and Waste Materials, Ohio Department of Natural Resources, 1988.

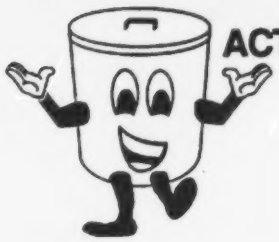


ACTIVITY #4
WHAT'S THE WRAP
DATA SHEET

Place the name of each of your items in the proper column.

NATURAL PACKAGING	MAN-MADE RECYCLABLE OR REUSABLE PACKAGING	UNNECESSARY MAN-MADE PACKAGING

Think of other items for each category...



ACTIVITY 5

PERFECT PACKAGING

Time: One 45-minute class period

Objectives:

Students will:

- determine the weight of pieces of gum with and without the packaging.
- compare and graph the weight of different types of gum and packaging.

State Goals - Knowledge/Skills Correlation:

Science:	I - D, N II - E III - B IV - B, E, F, G, M	**Social Sciences:**	I - E, O III - F IV - F, J V - A, C	**Math:**	I - E II - A, E III - E, G

Materials:

6 different types of gum (1 pkg. each type)
Copies of the data sheet
balances to weigh gum

Procedure:

1. Remind students that some packaging is necessary. For example, some packaging keeps items clean to protect our health (bandages, medicines). Other packaging preserves what is inside the package (food sealed in glass jars). Some packaging gives instructions on how to use the product and lists its ingredients. However, as learned in the previous lesson, there is a lot of unnecessary packaging.

2. Divide the students into groups of four and explain to them that they are going to weigh and graph information about the packaging of different brands of gum.

3. List the different brands of gums on the board, along with the price of each package.

4. Give each group a different package of gum and instruct the group to find the **total weight** of its pack of gum. Record the amount in grams on the data table.

5. Tell each group to unwrap all the pieces of gum and save all the pieces of wrapping.

6. Have students find the weight of the gum **only** and record the amount on their data tabl

7. Have them find the weight of the packaging **only** and record this amount on the data table. Do the two amounts add up to the total weight? (They should!)

8. Each group should calculate how much packaging would be thrown away if each student in the class chewed one pack of a particular brand of gum per week? per month?

9. Discuss how fast this amount of packaging grows if each student in the school chewed a pack of gum every week. Then ask each group to discuss the following questions:

    - How could some of the packaging be reduced?
    - What brand had the least packaging for the amount of gum bought?
    - How does the price of the gum compare to the amount received?
    - Which brand was cheapest and is this the most popular brand?
    - Can any of the packaging be reused or recycled? How?

10. Have each group report its findings to the class using information from its data table.

11. Students should create a bar graph of the gum's weight and/or the weight of the packaging for each brand of gum.

Evaluation:

Students will be evaluated:

— by teacher observation of student participation in the discussion and group activity.

— on their data tables and graphs.

Suggested Extensions:

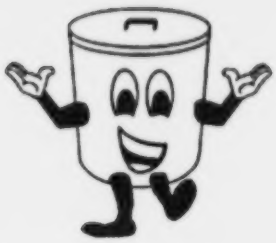
1. Students can write to companies whose packaging was found to be excessive, list their findings, and indicate their concerns and suggestions for better packaging.

2. If students are learning division, the cost per stick or piece of gum for each brand could calculated by dividing the cost of the pack by the number of pieces in the pack.

3. Gum wrappers can be made into a class design of excess packaging, or saved for a lesson on reuse.

Source:

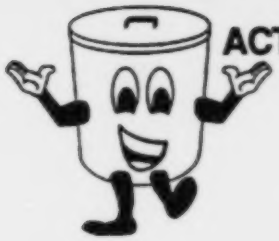
Miles, Betty. Save the Earth: An Action Handbook for Kids, 1974. Reissued, 1991. New York, N.Y.: Alfred A. Knopf.



ACTIVITY #5
PERFECT PACKAGING
DATA SHEET

Record your answers in grams.

NAME OF GUM	TOTAL WEIGHT OF GUM PACKAGE	WEIGHT OF GUM ONLY	WEIGHT OF PACKAGING ONLY	(x 5) = WEEKLY CLASS PACKAGING	(x 4) = MONTHLY CLASS PACKAGING



ACTIVITY 6

SECOND TIME AROUND

Time: Three 45-minute class periods

Objectives:

Students will:

- demonstrate ways to reuse waste items by constructing puppets from trash.
- create a puppet show on a solid waste topic.

State Goals - Knowledge/Skills Correlation:

Science:	II - C, F, G IV - F	**Social Sciences:**	II - F IV - F V - A, C, K, M	**Math:**	III - E

Background Information:

Reusing items is another way to reduce waste. Using the back of a used sheet of paper for scratch work is one good idea. That way, a new piece of paper does not have to be manufactured just for scratch paper. Metal cans and plastic bottles can be used to hold pencils, as paint cans, or for any number of other uses.

Another example of reuse is the purchase of soda in washable returnable bottles. These bottles can be returned to the store, then sent to the plant to be washed and refilled. The same bottle can be used up to 30 times before it breaks. If nonrecyclable bottles are used instead, a new container must be manufactured for each bottle of soda. Up to 30 new containers would need to be made instead of only one reusable bottle. This is why it is important to think about ways to reuse items and to purchase items that do not have "one-time" uses.

NOTE: Two-liter plastic bottles are recyclable. Some are made into new two-liter bottles and others can be made into carpeting, fiberfill for parkas and sleeping bags.

Materials:

Reusable trash items (brought by students)
Scissors
Tape
Markers
Pencils
Crayons
Teacher-collected items
Glue
Paper
Paint

Preparation: (2-3 days prior to lesson)

Ask students to bring trash items from home that can be used for making a puppet. Suggested items include: shopping bags, paper lunch bags, plastic milk jugs, envelopes, polystyrene (styrofoam) fast-food containers, fast-food bags. Items such as felt scraps, old buttons, pipe cleaners, construction paper scraps, and yarn should be made available to add decorative touches to the puppets.

Procedure:

1. Read "Hector the Collector" by Shel Silverstein to the class. Discuss the students' reactions to the poem. Ask them for the meaning of the last four lines.

2. Have students brainstorm ideas and ways to reuse some of the items that have been brought from home and those provided by the teacher.

3. Put students into groups of five. Let them create puppets from their items or items from past lessons.

4. During the next class period, or when the puppets are finished, have each group create a skit for a puppet show illustrating some aspect of the 3 R's—reducing, reusing, and recycling solid waste. Here are some ideas:

   - The trash was saved from the landfill. What was the trash used for BEFORE it became a puppet?
   - Think of the 3 R's. Create a puppet show to describe reducing, reusing, and recycling, and how the 3 R's will help eliminate the solid waste crisis.
   - Demonstrate why it is important to reuse items.
   - You enter a time machine and go back into the past. Tell how things have changed with respect to solid waste.
   - Let students imagine how the earth will be in the future and use their puppets to create a play about it.

5. When the puppets and writing are completed, have the students present puppet shows for their class or for other classes to increase their awareness of solid waste issues.

Evaluation:

Students will be evaluated:

— on their participation in the discussion on ways to reuse trash items.

— on their ability to create a puppet, and a skit about solid waste.

Suggested Extensions:

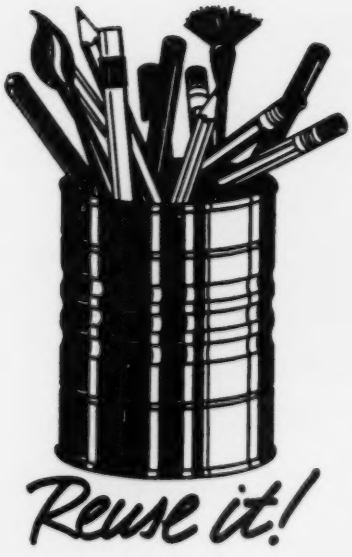
1. Students can make a display or mural in a prominent location using the puppets they have created to help educate other students in the school.

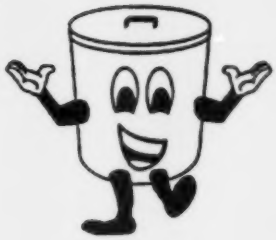
2. Take a field trip to a soft drink bottling company or plastic recycling plant.

Sources:

Johnson, Donna. R.O.A.R. Illinois Department of Energy and Natural Resources, Springfield, Illinois, 1991.

Silverstein, Shel. Where the Sidewalk Ends, Harper & Row, 1974.





ACTIVITY #6
SECOND TIME AROUND
POEM SHEET

Hector the Collector

by Shel Silverstein

Hector the Collector
Collected bits of string,
Collected dolls with broken heads
And rusty bells that would not ring.
Pieces out of picture puzzles,
Bent-up nails and ice-cream sticks,
Twists of wires, worn-out tires,
Paper bags and broken bricks.

Old chipped vases, half shoelaces,
Gatlin' guns that wouldn't shoot,
Leaky boats that wouldn't float
And stopped-up horns that wouldn't toot.
Butter knives that had no handles,
Copper keys that fit no locks,
Rings that were too small for fingers,
Dried up leaves and patched-up socks.
Worn-out belts that had no tracks,
Airplane models, broken bottles,
Three-legged chairs and cups with cracks.
Hector the Collector
Loved these things with all his soul-
Loved them more than shining diamonds,
Loved them more than glistenin' gold.
Hector called to all the people,
"Come and share my treasure trunk!"
And all the silly sightless people
Came and looked...and called it junk.

Text and illustration from Shel Silverstein, *Where the Sidewalk Ends*, Copyright © 1974 by Shel Silverstein.
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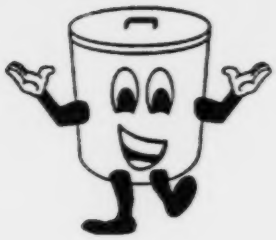
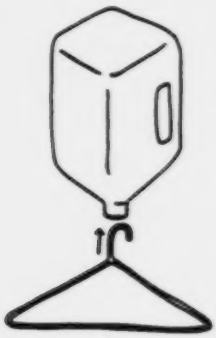


ACTIVITY #6
SECOND TIME AROUND
PUPPET EXAMPLES

Plastic Bottle Puppet

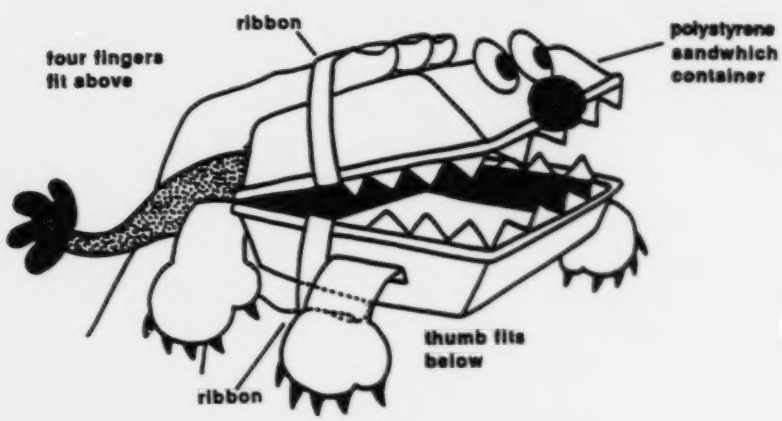
1. Thoroughly wash out a plastic bottle (milk, liquid soap, Clorox, etc.)
2. Create features on opposite surface from handle.
3. Tape coat hanger wire into neck of bottle (or insert into neck) for shoulders.

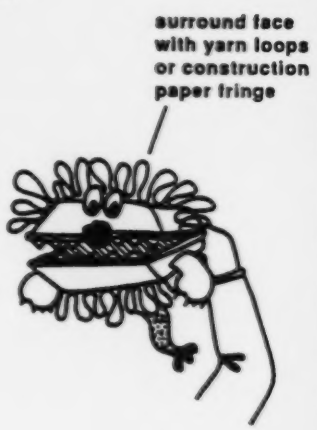


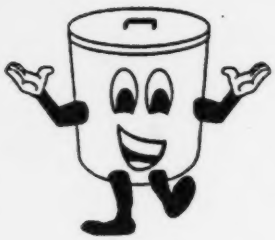
Taken from: Puppetry and Creative Dramatics in Storytelling. *Austin. Nancy Renfro Studios, 1980.*

Sandwich Container Puppet

Most fast food establishments will be willing to give you enough containers for your class, just ask. Craft glue must be used - not regular white glue.

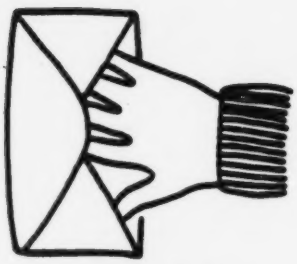




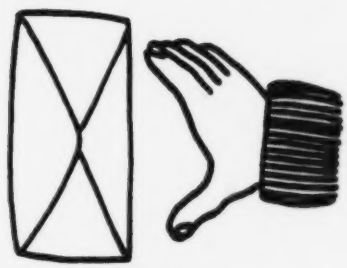


ACTIVITY #6
SECOND TIME AROUND
PUPPET EXAMPLES

Junk Mail Puppets

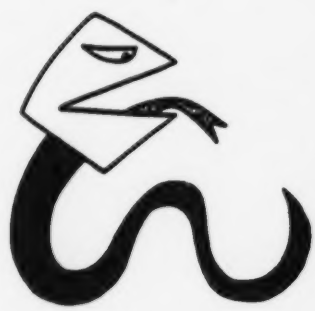


To make the head put flap of envelope inside

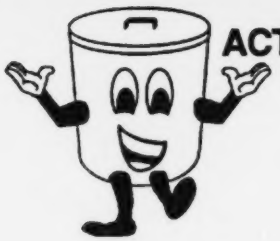


Slide hand into corners of envelope

To form mouth, "bite" your other hand with envelope



Snake and rabbit from: *Making Amazing Puppets*. by Nancy Renfro and Beverly Armstrong. © 1980.



ACTIVITY 7

NEW NEWS IS GOOD NEWS

Time: Two 45-minute class periods

Objectives:

Students will:

- describe the importance of trees to the environment.
- identify reasons for recycling paper.
- describe the papermaking process.
- make recycled newspaper from old newsprint.

State Goals - Knowledge/Skills Correlation:

Science:	I - D, J, E II - F, G, B IV - A, E, F, J	**Social Sciences:**	III - F IV - D, F, H,I J, K V - A, B, C, H, M	**Math:**	III - A, E

Background Information:

Paper, which is made directly from trees, is called "virgin paper." When a softwood tree grows to be about 20 feet to 30 feet tall (which takes about 30 years), it is chopped down. The cut trees are sent to a mill, where they are processed into chips. The chips are mixed with water and chemicals, and cooked into an oatmeal-like mush called "pulp." The pulp is spread onto a screen and the water is pressed out. The pulp is dried, flattened and stretched into sheets. The paper is then rolled onto large tubes and sent to printing companies. Each company makes paper for its own products, which we buy and use.

To save trees, new paper can be made out of old paper. The old paper is shredded, soaked in water, and made into pulp that is used for paper similar to virgin paper. Used paper can also be made into roofing felt, insulation, fiber pipe, packaging, wall board, and cardboard.

Recycling paper saves trees. Americans use 50 million tons of paper every year, which means that more than 850 million trees are consumed. Recycling a four-foot stack of newspapers will save one 40-foot pine tree.

There are other important reasons for saving trees:

- Trees convert carbon dioxide to oxygen.
- Trees prevent soil erosion.
- Trees supply food for plants and animals that are part of the food chain.
- Trees provide a cooling effect on the earth because of the moisture released to the atmosphere (rain forests).
- Trees provide us with many products that make our lives easier and more comfortable.
- Trees provide us with pleasure and beauty.

Recycling paper also saves valuable landfill space. A ton of recycled newsprint saves three cubic yards of landfill space. The recycling process saves raw materials, uses 30 percent to 55 percent less energy, and causes less pollution than making new paper from wood. If everyone in the United States recycled or reused as little as one-tenth of their newspaper, we would save approximately 25 million trees every year.

Materials:

1 blender (teacher-supplied)
2 1/2 single pages from a newspaper
1 whole section of a newspaper
5 cups water
1 9" x 13" aluminum pan (3" deep)
2 pieces of window screen (11" x 7") that fit inside the pan
1 measuring cup
1 rolling pin

Procedure:

1. Have students collect the paper they use in the classroom, which would normally be discarded, FOR ONE WEEK.

2. Tell them to divide the collected paper into two categories:

   a.) paper that has been **partially** used, and
   b.) paper that has been **completely** used.

3. Keep the partially used paper in a box somewhere in the classroom and use it for scratch paper or for other appropriate assignments.

4. Discuss the fact that paper is made from trees and ask students to list reasons why they think trees are a valuable resource.

5. Have them brainstorm ways that the amount of paper used could be reduced or reused (e.g., the classroom box of partially used paper).

6. Discuss what happens to paper when it is thrown away. Include the facts that paper takes up space and decomposes very slowly in a landfill.

7. Ask students what might be done with paper that has been used completely. Introduce the concept of recycled paper and discuss the benefits of this process.

8. Describe the papermaking process (e.g., trees - logging - log truck - paper mill - truck - wholesale warehouse - store/printing companies - you).

9. Explain to the students that they will be making recycled paper from old newspaper.

Procedure for Making Paper:

This activity may be done as a demonstration with assistance from the entire class, or the class may be divided into several small groups to allow each group the opportunity to make its own paper.

1. Tear the 2 1/2 pages of newspaper into tiny pieces.
2. Drop the pieces into the blender.
3. Pour 5 cups of water into the blender.
4. Cover the blender to prevent the splattering of newspaper mush and switch the blender on for a few seconds, or until the paper turns into pulp.
5. Pour the blended paper (pulp) into a measuring cup.
6. Put one piece of screen into the pan.
7. Pour 1 cup of blended paper pulp over the screen and spread the pulp evenly with your fingers.
8. Lift the screen and let the water drain.
9. Place the second screen on top and squeeze out the excess water.
10. Open the newspaper section to the middle.
11. Place the screen with the pulp into the newspaper and close.
12. Use the rolling pin to press out the excess water.
13. Open the newspaper and take out the screen.
14. Allow the pulp to dry at least 24 hours.
15. Check to see if the pulp paper is dry the next day, and if it is dry, carefully peel the paper off the newspaper.
16. Now the paper is ready to write on!

An Idea for Language Arts:

Have the students imagine they are editors of a newspaper and must make a decision on purchasing recycled paper or virgin paper. Have them list the advantages or disadvantages of their decisions with respect to saving the earth.

Evaluation:

Students will be evaluated:

— on their list of the pros and cons of using virgin vs. recycled paper.

— by making a poster illustrating the importance of trees.

Suggested Extensions:

1. Take a field trip to a local nursery. Have the nursery worker point out the types and ages of various trees, how the trees are maintained, the cost of the various trees, and which types are used to make paper.

2. Plant a tree on the school grounds. Students can observe changes over time, look for animal visitors, as well as measure and chart the tree's growth.

3. Take a trip to a paper mill or paper recycling plant.

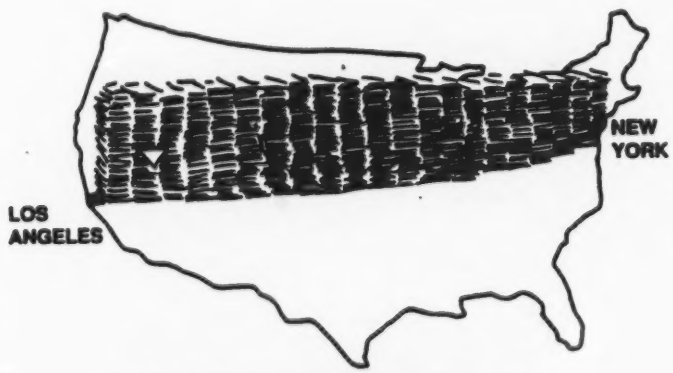
Sources:

It's Your Environment—Things to Think About, Things to Do, Environmental Action Council, Charles Scribner & Sons, New York, 1976

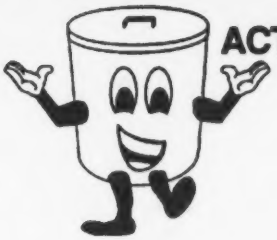
The Kids Earth Works Group, 1400 Shattuck Avenue, #25, Berkeley, CA 94709.

Recycling Guide, St. Louis Post Dispatch, 900 N. Tucker Blvd., St. Louis, MO 63101-1099.

Solid Waste Activity Packet, Illinois Department of Energy and Natural Resources, Springfield, Illinois, 1990.



With the office and writing paper we throw away in the U.S. every year, we could build a 12-foot high wall from Los Angeles to New York City.



ACTIVITY 8

DOWN BY THE RIVERSIDE

Time: Two 45-minute class periods

Objectives:

Students will:

- identify seven frequent sources of trash in the neighborhood.
- describe the effects of trash pollution and identify ways in which it can be prevented or reduced.

State Goals - Knowledge/Skills Correlation:

Science:	I - D II - C, F, G, H IV - A, B, C, F, G, H	**Social Sciences:**	II - F III - F IV - F, H V - A, M	**Math:**	I - A

Background Information:

Often, trash is carelessly scattered in areas of our neighborhood or around our school.This trash appears when people discard items without thinking about the consequences. But trash in our neighborhoods also **unintentionally** appears as leftovers from trash removal, from uncovered transportation vehicles, and from construction and demolition activities. Keep America Beautiful, Inc., lists the following sources as potential areas of concern:

- Leftover trash from household cans
- Leftover trash from loading docks, storage bins and large dumpsters
- Commercial trash leftovers (businesses)
- Motorists
- Construction/demolition sites
- Uncovered vehicles (usually trucks)
- Pedestrians

Trash can be found almost anywhere—along roadways, in our neighborhoods, in forests, parks, schoolyards, and on streets. Two percent of the country's solid waste ends up as trash scattered throughout our environment. This trash is not only unsightly, but it also can create many other problems. If trash accumulates in areas for a long time, it can provide a breeding habitat for animal pests. Animals, and people as well, can injure themselves on discarded trash. It costs money to hire sanitation crews to clean up the mess, or repair/replace property ruined by trash.

Laws protecting the environment from scattered trash have improved conditions in many areas, but we have not yet won the battle. Many adults and children still believe that trash thrown on the ground or in the school hallways is someone else's problem. It is this attitude that must change if we are to help improve the solid waste problem.

Materials:

30 paper lunch bags
pencils
paper
copies of the data sheet

Procedure

1. Introduce the subject of roadside trash and open dumps, trash in school hallways, etc.

2. Have students express their feelings about this type of trash problem and how it affects the appearance (aesthetics) of the environment.

3. Give each student a "Trash Sources" worksheet. Draw three types of faces on the board for the students to choose from:

Happy

Sad

Funny

Students should draw one face in the circle next to each picture to express their feelings about what is happening in the picture. (Picture C should be the only happy face).

4. Discuss the answers and have the students describe the sources of trash in each picture (see background information.) List the seven most frequent trash sources on the board.

5. Ask students to explain how the trash got to be where it is in the picture. Explain that wind and animals may carry trash from open or even closed containers, but that humans are often at fault.

6. Give each student a small paper bag and take students on a trash walk around the school yard and surrounding neighborhood.

7. When they are back in the classroom, observe the trash collected and have students record the sources (from the seven listed on the worksheet or others) for the trash they find. Each student or group may select one piece of trash and explain to the class how that item became trash, perhaps through a first-person account.

8. Have students brainstorm problems the trash causes, besides being unsightly (such as harm to animals, injurious to people, breeding place for disease causing pests, such as mosquitoes in old tires).

9. Discuss what happens to trash if it is not picked up, introducing the terms biodegradable and nonbiodegradable, if appropriate. Otherwise, use the word "rot" to describe biodegradable trash.

10. Discuss solutions to the trash problem and the role students play in the solutions.

An Idea for Language Arts:

Have students sing the songs from the song sheet. Discuss the meaning of the lyrics. Students can then create songs of their own.

Evaluation:

Students will be evaluated:

— on teacher observation of student participation in the trash discussion.

— for completeness of the "Trash Sources" worksheet.

— by their descriptions for sources of trash they have collected.

Suggested Extensions:

1. Take photographs of or find magazine pictures of places where trash exists and identify the source of the trash.

2. Initiate a community and/or school-wide clean-up project.

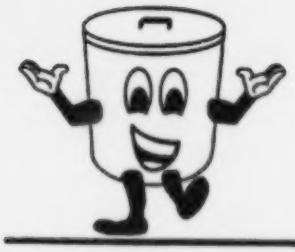
3. Have students create posters to be placed around the school that demonstrate ways to reduce trash in the environment.

Sources:

James, Regina and David Landis. At the Source, Ohio Department of Natural Resources, 1988.

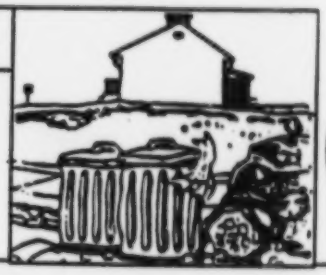
Keep America Beautiful, 99 Park Avenue, New York, NY, 10016.

Nickoli, Karen. This Littered Land is Your Land, Ohio Department of Natural Resources, 1988.



ACTIVITY #8
TRASH SOURCES
WORKSHEET

A



B

C

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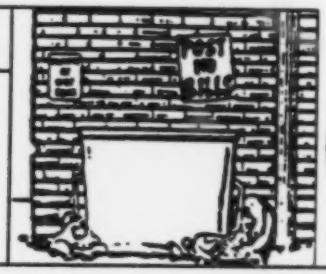

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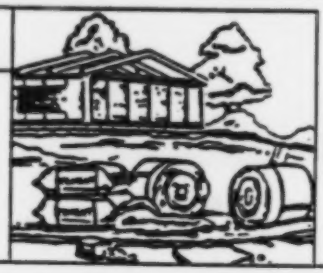
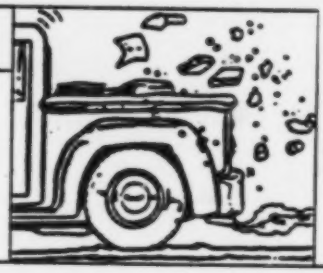
F



G



H

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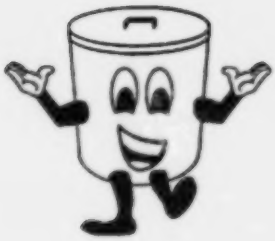


ACTIVITY #8
DOWN BY THE RIVERSIDE
MUSIC SHEET

TRASH SONGS

To the tune of "Three Blind Mice"

1 Three litter bugs, three litter bugs
2 See how they litter, see how they litter
3 You find them wherever trash is found
4 They aren't very nice to have around
5 They throw trash and garbage on the ground
6 Three litter bugs

To the tune of "Row Row Row Your Boat"

1 We can use our trash
2 Save it from the can
3 Recycle! Recycle! Recycle! Recycle!
4 That's our final plan

To the tune of "Frère Jacques"

1 Please don't litter, please recycle
2 Glass and tin, aluminum
3 Paper, cardboard, plastic, once again fantastic
4 Recycle, Recycle

ACTIVITY 9

IT'S HAPPENING AT THE DUMP

Time: One 45-minute class period for lesson, with biweekly observations of the mini-landfill for at least two months

Objectives:

Students will:

- identify the advantages and disadvantages of, and alternatives to, landfills.
- construct a mini-landfill.
- distinguish between materials that decompose and those that do not easily decompose in landfills.

State Goals - Knowledge/Skills Correlation:

Science:	I - D, I, L II - C, F, G, H III - B IV - A, B, C, E, F, G	**Social Sciences:**	I - F II - F III - H IV - F, G, H V - A	**Math:**	III - A, E

Background Information:

In the United States, we throw away approximately 160 million tons of garbage each year. Almost all the garbage is taken to landfills. In 1989, Illinois alone placed approximately 13 million tons of garbage in our landfills.

When properly located, constructed, and maintained, landfills are an improvement over open dumps that were common prior to 1970. Open dumps are plagued with insect and rodent problems, can pollute surface water and groundwater, cause air pollution through the open burning of waste, and create an offending odor to neighboring homes.

Landfills make it easy for people to put all their trash into bags or cans and have it hauled away. However, landfills are only part of the solution to the solid waste problem. Garbage buried in landfills wastes valuable land and energy. Natural resources may be lost forever. Most landfills are reaching capacity and new landfill sites are difficult to find due to strict guidelines and citizen opposition. Landfills, although thought to be a cheap way of garbage disposal, are actually expensive when the costs of collecting, hauling, and burying the garbage are considered and when environmental protection is maintained. Alternatives, such as waste reduction, recycling, and composting, will help lessen the amount of trash that ends up in a landfill.

Products such as glass, metal, plastic, and rubber do not easily decompose (rot) in landfills. Products that can disintegrate or decompose include paper, wood, cloth, food waste, and yard waste. In many landfills, however, little or no decomposition of buried waste materials occurs. Paper may take from 6 years to 60 years to decompose depending on many factors. When the decomposition of organic waste does occur in landfills, it allows these organic materials to return to the earth as the natural components from which they came. By-products of this decomposition include methane gas and carbon dioxide. Depending upon the type of garbage buried, liquid chemicals may pollute groundwater.

Materials for Mini-landfill Construction:

6 mini-aquariums, or clear plastic shoeboxes
Sand
Charcoal
Garden soil (not potting soil)
Vegetable scraps (avoid cabbage, mustard greens, and fruit)
1 roll of masking tape
6 metric rulers
Scoops or cups for pouring sand, soil, and charcoal

Sample Objects for Mini-landfill:

6 marbles
6 popsicle sticks
6 rubber bands
6 plastic buttons
6 scraps of cotton cloth
6 paper clips
6 pieces of paper bag
6 small pieces of aluminum foil

Preparation:

Collect vegetable scraps (NO MEAT SCRAPS) for the landfill and have them available to students. Avoid cabbage and mustard greens (due to the odor) and fruits (they become mushy). Potting soil is sterile and does not contain the necessary microorganisms necessary for decomposition. Although garden soil is **preferred**, potting soil will suffice since some microorganisms are present on the vegetable scraps.

Procedure:

1. Have students discuss where things go when they are thrown away.

2. Explain how landfills are constructed (use the landfill diagram) and the advantages of landfills over open dumps.

3. Ask students:

   - to describe disadvantages of landfills and brainstorm ideas for possible solutions to the problem of limited landfill space.

   - to explain what happens to waste materials in the landfill and, if appropriate, introduce the term "decomposition " or "rot." (While the term "decomposition" has been used throughout this activity, the term "rot" can be substituted for the younger student.)

   - to name materials that decompose and those that do not easily decompose. If appropriate, introduce the phrase "organic waste." If not, explain to the students that living organisms, given the right conditions, are easily decomposed.

4. Tell the students that decomposition of even organic waste in a landfill is extremely slow and many materials do not decompose at all. The lack of air and moisture prevents this decomposition.

5. Explain to the students that they will construct mini-landfills and perform an experiment to see what materials will decompose in their mini-landfills.

6. Divide students into groups of five. Each group should obtain the materials necessary for the mini-landfill construction and follow this procedure for its mini-landfill construction:

   a. In the small aquarium, have students layer **in order** the following materials: 5 cm of sand or gravel (to absorb moisture,) a thin layer of moist charcoal (to prevent odors,) 10 cm of soil, 5 cm of vegetable scraps, 2 cm of soil. To simulate the conditions of a real landfill, it is important to press or pack each layer down firmly and to eliminate all empty spaces within the layers.

   b. After the mini-landfill is completed, have students select five different sample materials from the list above and place them in the bottom soil layer of the mini-landfill. Use a pencil or ruler to push them down. Place them near the side where they can be easily observed. Have students prepare masking tape labels to identify each material.

7. Students should observe/record the answers to these questions:

   - Which objects do they think will begin to rot first?
   - Which object or objects will take the longest to rot?
   - Which objects might never rot in the mini-landfill?
   - Which objects in the mini-landfill are made from organic materials?
   - How is the mini-landfill different from a real landfill?
   - What things can you and your family do to help solve the landfillproblems?

8. Have students use their senses to observe the landfill two times a week for two months. Students should record their observations on the data sheet. Landfill observations may continue throughout the year for an excellent long-term project.

9. After two months or when appropriate, close the lesson with a group discussion of the student observations. Make a class chart on the board of the sample objects, grouping them as follows: rotted quickly, rotted slowly, did not rot at all. Encourage students to predict into which group other objects would be placed.

Evaluation:

Students will be evaluated:

— on teacher observation of student participation in the discussion of landfills.

— by observing the student's ability to follow instructions in the construction of mini-landfill.

— upon completion of the student data table and correct answers to questions.

Suggested Extensions:

1. Take a field trip to a landfill site.

2. Make a 3-D model of a landfill as an art project, from reused materials. (See Solid Waste Activity Packet, Chapter V, "Residue: Landfill and Incineration.")

3. Have students write their own poems or songs about landfills and share them with the class.

4. Discuss the fact that many people believe that dumping garbage into the oceans is a solution to the landfill problem. Get student reactions to this solution and explain that though the oceans are large, they still become polluted when used for waste disposal. Have students sing "My Garbage Floats In the Ocean" to the tune of "My Bonnie Lies Over the Ocean."

My Garbage Floats in the Ocean

My garbage floats in the ocean. My garbage floats in the sea,
My garbage floats in the ocean. My garbage comes back to me.
Come back, come back, come back my garbage to me, to me.
Come back, come back, come back my garbage to me.

5. Students may also perform the following **"Swan Dive Lake"** experiment:

   Fill a large glass jar with water and add trash ingredients such as small pieces of fruit peelings, motor oil, iron nails, glass, paper, plastic, polystyrene, aluminum, cloth, etc. Let the jar stand and observe it every day for two weeks. Have students answer the following questions:

   - What happened to the water?
   - What happened to the pieces of trash?
   - Would you like to swim in water like that? Why or why not?
   - What might happen to plants and animals who lived in the water?
   - Is the ocean big enough to take all our garbage without poisoning the organisms that live in it?

Sources:

Breaking the Landfill Habit, Minnesota Pollution Control Agency, 1985.

Delaware Solid Waste Authority, diagram of landfill cross-section.

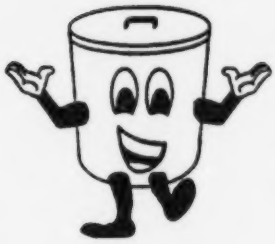
Earth Works Group. 50 Simple Things You Can Do to Save the Earth, Earthworks Press, 1989.

Lamb, Marjorie. 2 Minutes a Day for a Greener Planet, Harper & Row, 1990.

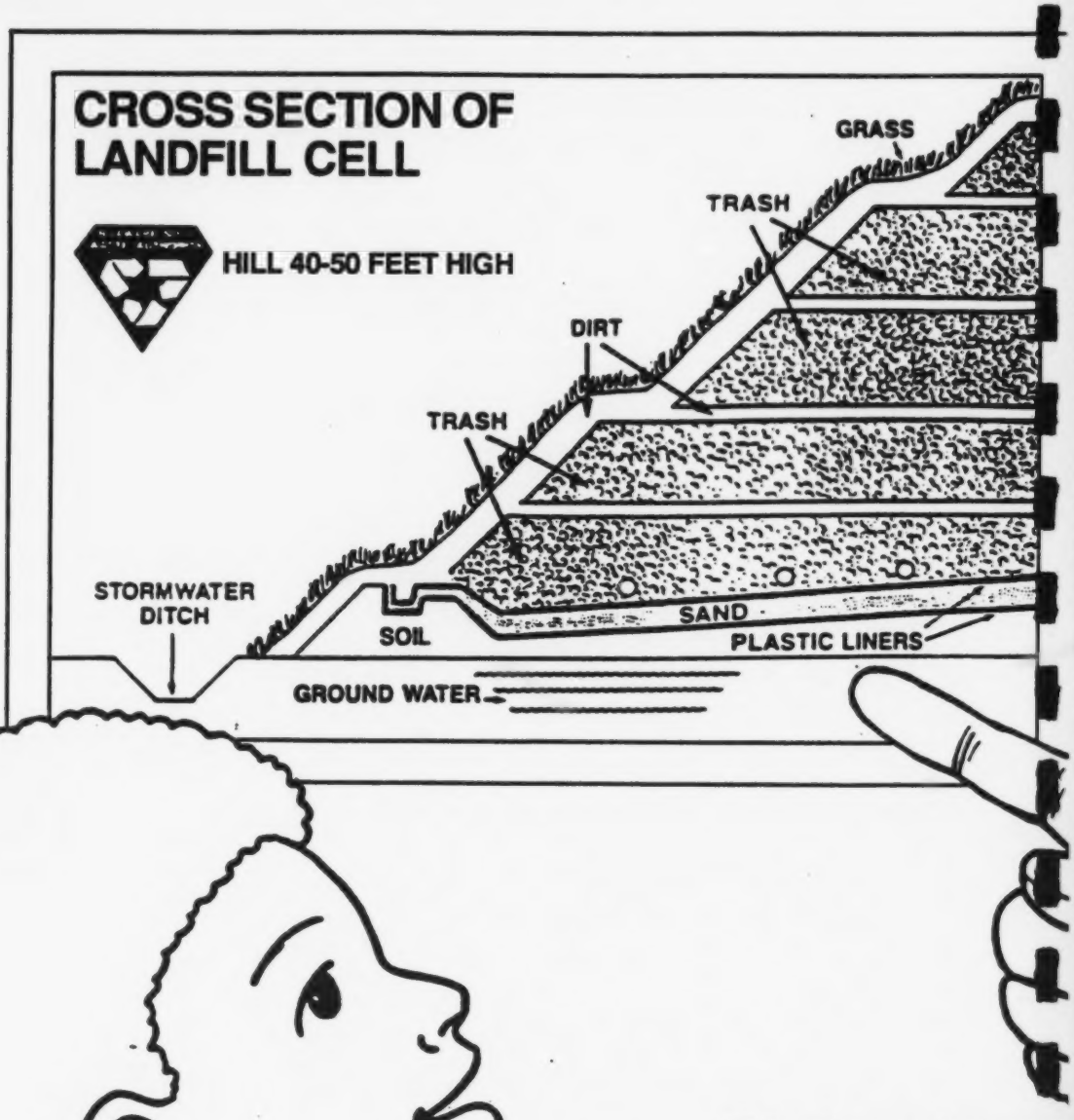
Miles, Betty. Save the Earth: An Ecology Handbook for Kids, 1974, Alfred A. Knopf, revised 1991.

Solid Waste Activity Packet, Illinois Department of Energy and Natural Resources, Springfield, Illinois, 1990.

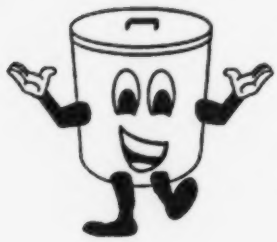
Wiziecki, Edee Norman, et. al. Solid Waste: From Problems to Solutions, Illinois Department of Energy and Natural Resources, Springfield, Illinois, 1990.



ACTIVITY #9
IT'S HAPPENING AT THE DUMP
DIAGRAM

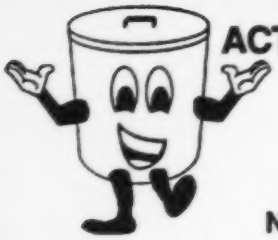


This shows what each
area or "cell" looks like
inside. Soil covers all
the trash, and when it's
finished, grass is planted
and it will be a grassy hill



ACTIVITY #9
IT'S HAPPENING AT THE DUMP
DATA SHEET

DATE	WHAT DO YOU SEE?	WHAT DO YOU SMELL?	WHAT OTHER OBSERVATIONS CAN YOU MAKE?



ACTIVITY 10

NOW YOU SEE IT, NOW YOU DON'T ... SOMETIMES

Time: One 45-minute class period, with two weeks for observation

Objective:

Students will:

- describe the difference between materials that rot (biodegradable) or do not easily rot (nonbiodegradable).

State Goals - Knowledge/Skills Correlation:

Science:	I - D, I II - F, G, E IV - A, B, G	**Social Sciences:**	III - B, F IV - F, G, I V - E, K, M	**Math:**	III - A, E

Background Information:

Biodegradable materials are materials that decay or are broken down into simpler forms over tim by living things. Biodegradable materials, once broken down, become part of the soil. These m terials do not biodegrade at the same rate. It takes a piece of paper approximately one month and a woolen sock one year to become part of the earth again under proper conditions. Not all materials are biodegradable. For example, plastics and aluminum are not biodegradable. Thes nonbiodegradable materials cannot be broken down by living things and do remain much in their same form long after they have been thrown away. Remember, there is little or no decompositio of materials in landfills due to lack of oxygen and moisture. (See Activity 9)

Materials:

Small pieces of waste (to be collected)
8-oz. plastic containers (reusable) for each student
Table scraps—avoid using meat, cheese, and eggs
Soil
Cardboard
Water
Aluminum foil
Paper
Popsicle sticks
Plastic wrap

Preparation: (1-2 days prior to lesson)

Collect, or have students collect, waste items and vegetable scraps to be used in the lesson.

Procedure:

1. Review the terms "biodegradable" and "nonbiodegradable," if appropriate. Otherwise, use the terms "rot" and "does not rot." Discuss the problems caused by materials that do not rot.

2. Inform students that they will make a comparison study using the collection of waste items their families might have thrown away. The students will try to determine which waste items will rot and which items will not rot.

3. Have each student fill a plastic container with soil to within one inch of the top, and "bury" the small bits of waste at various depths.

4. Place the materials close to the outer edge of the cup leaving space between the materials for easy viewing.

5. Sprinkle a small amount of water on the soil and cover the cup with plastic wrap. Observe the cup every few days for one month.

6. Maintain a loose soil by stirring with a popsicle stick every 2-3 days.

7. Develop a list of common waste items. Use the items from the experiment as well as other items. Items from a trash walk may also be used—see Suggested Extension 1.

8. Help students decide what items on the list are biodegradable or are not biodegradable. Have them record their results on the data table. You may also want to discuss the decomposition rates of each biodegradable item.

An Idea for Language Arts:

Students can write a description about the world of the future. In what kind of world would they like to live? Have them hypothesize about what changes must be made in the present environment to reach their ideal and what measures must be taken in the future to prevent additional harm to the environment.

Evaluation:

Students will be evaluated:

— through their study and discussion of items that changed and items that stayed the same.

— on the completeness of their recorded observations.

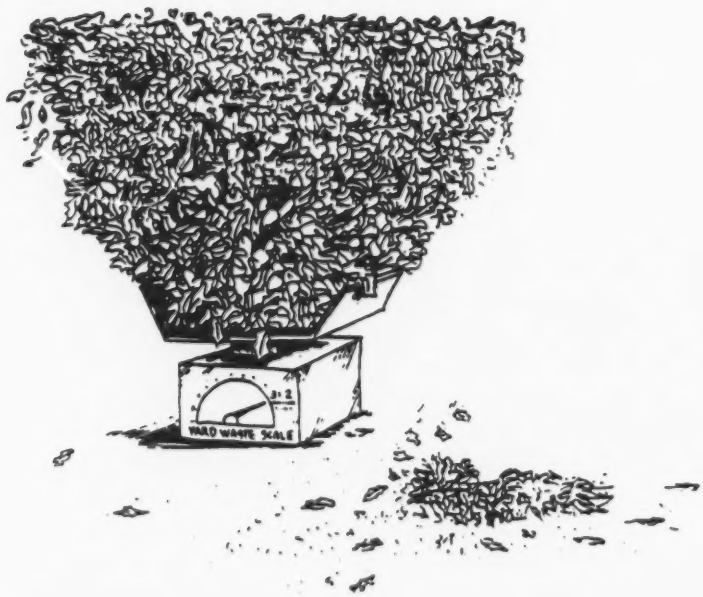
Suggested Extensions:

1 Take a walk around the school yard or a nearby park collecting trash. Make collages out of some of the trash found on the walk. While taking the walk, record the number of instances of observed biodegradable trash. (Do not attempt to collect this trash.) Decide if any of the materials found on the walk are recyclable.

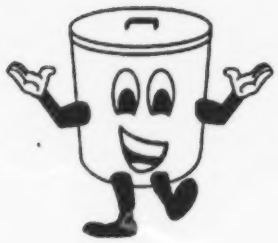
2. Students can compose a rap using the term "trash."

Sources:

Keep America Beautiful, 99 Park Avenue, New York, NY 10016



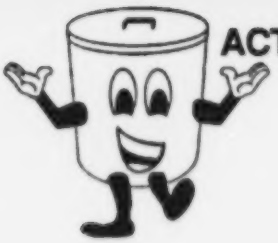
We throw away 31.6 million tons of yard waste each year in the United States.



ACTIVITY #10
NOW YOU SEE IT, NOW YOU DON'T ... SOMETIMES
DATA SHEET

Place an "X" in the correct column for each item.
If you are not sure, put a "?" by the item name.

ITEM NAME	ROTS	DOES NOT ROT



ACTIVITY 11

COMPOST MAGIC

Time: One 45-minute period, additional time for compost observation

Objectives:

Students will:

- describe what a compost is and how it works.
- identify the benefits of composting.
- construct a mini-compost.

State Goals - Knowledge/Skills Correlation:

Science:	I - I, J II - B, F, G III - B IV - A, C, E, G, M	**Social Sciences:**	II - F III - B, F IV - D, E, F, G, H, I V - A, C, M	**Math:**	III - A, E

Background Information:

Composting is based on the biological process of decomposition. In a compost heap, microorganisms, such as bacteria, break down most of the organic wastes into a nutrient-rich "humus" or compost. Modern landfills seal garbage in the earth, excluding air and moisture, and preventing the organisms from breaking down the material. Neither a paper bag nor a plastic bag may fully decompose without air or moisture.

Composting, however, allows air and moisture to speed up the decomposition process. The temperature, moisture content, oxygen level, source of organisms, and the nature and particle size of the decomposing material also affect the composting process. The decomposition process produces heat.

A good compost produces an excellent natural soil enhancer and reduces the amount of solid waste dumped in landfills. Every year Americans throw away 24 million tons of leaves and grass alone. The average cost of composting these materials, $35 per ton, is much less than the cost for burying it in a landfill, $65 per ton.

Bins for composting can be constructed in many ways. The bins may be as simple as heaping last year's leaves in an out-of-the-way corner of the yard and allowing them to decompose slowly, or as complicated as an elaborate city-wide compost facility.

Compost bins may be built from chicken wire, stones, bricks, fencing, or other materials. Whatever the compost structure, composting should be done in a partially shaded area. The compost pile should include the following layers: **a carbon layer** made of dried leaves, straw, wood chips or sawdust, etc.; **a nitrogen layer** made of vegetable matter, coffee grounds, lawn clippings, leaves, weeds, manure, but no meat scraps or pet waste; and **a soil layer** consisting of garden soil, which introduces microorganisms.

A compost pile should not smell when properly constructed. If it does smell, it may be too moist and requires additional dry materials. Shredding organic matter into smaller pieces will speed up the decomposition process. Turning the compost pile every few days so that the outside of the old pile becomes the inside of the new pile also speeds up the composting process, and provides necessary air circulation. When the compost is finished, it may be used to enhance garden soils, as potting soil for house plants, or sprinkled on the lawn as a natural fertilizer.

In Illinois, yard waste was banned from landfills on July 1, 1990. Composting can reduce yard waste **volume** by 70 percent to 80 percent. And composting in summer and fall can help reduce residential trash by 50 percent.

For more information on the construction of a compost bin, call the ENR Information Clearinghouse at 800-252-8955 for a copy of the brochure entitled, A Home-owner's Guide to Recycling Yard Waste.

Materials:

6 gallon milk cartons with small holes
1 roll masking tape
Water
6 rulers
6 thermometers
6 markers
6 popsicle sticks

Preparation: (3-5 days prior to lesson)

Students may be asked in advance to save and bring in organic materials for composting. The teacher should provide examples for students and may wish to bring in additional composting materials.

Some Suggested Compost Materials:

carbon layer	nitrogen layer	soil layer
shredded newspaper	green leaves	garden soil
dried leaves	weeds	finished compost
straw	grass clippings	
sawdust	vegetable scraps	
cornstalks		

Procedure:

1. Review decomposition with students and ask them to describe the nature of organic material. How much of this material is thrown away every day by their families and is dumped into landfills?

2. Introduce composting to students as a way to put nutrients back into the soil through natural decomposition. Explain that organisms, such as bacteria and fungi, break down the organic waste into natural components and produce a nutrient-rich material called "humus." Humus can be used as a soil enhancer for gardens and flower beds.

3. Ask if any of the students' families have composts. If so, allow them to share information about their compost heap with the class.

4. In order to "work," a compost heap needs:

   carbon + nitrogen + soil (microorganisms) + air + water

   Write this formula on the board with examples from each layer listed above. Tell students that the soil layer is added to introduce microorganisms into the compost pile. They are responsible for decomposition.

   Stress the fact that in sealed landfills, the air and water are not available for the decomposition process to take place.

5. Explain that compost materials will take time to decompose and the temperature will rise as the decomposition process is taking place.

6. Tell students that each group will make a small compost in a small plastic basket and will observe the changes that take place in it.

7. Divide the students into groups of five and provide them with the materials for making their compost.

8. Have students layer one or more of the materials from each of the following groups into their compost in approximately 7-8 cm layers: carbon materials, nitrogen materials, soil. Sprinkle top with a small amount of water.

9. Each group should place a thermometer into the compost, not touching the bottom or sides, but readable from the outside. On the data sheet have students record the initial temperature.

10. Have students mark the initial level of the compost on the container (or on a piece of tape placed on the container). Place the date beside the mark. On their data tables, have students record in centimeters the initial height of the compost from the bottom of the container.

11. Have students record the compost temperature and height daily for at least one month. Students may turn their compost with a popsicle stick.

12. After one month, share the group results and discuss what might have caused differences in the data. Continue compost observations if desired.

13. If appropriate, have each group graph the change in temperature or change in height of the compost vs. time.

14. At some time during the compost activity, teach students the song "Banana Peel Blues" (sung to the tune of "Take Me Out to the Ballgame"). Discuss the significance of the lyrics.

Banana Peel Blues

Take me out to the compost; Take me out to the heap.
Grind me up in a food grinder; I don't care if I'm chopped into bits,
'Cause it's root root root for the microbes; If they don't live it's a shame.
For it's two, four, six weeks I'm out to the old garden.

Evaluation:

Students will be evaluated:

— on their accurate description of how a compost works.

— by their list of benefits to composting.

— through teacher observation of their construction of a mini-compost.

Suggested Extensions:

1. Have each group prepare composts varying the amounts of the carbon and nitrogen materials. Compare the progress for the different composts. Discuss the factors that have affected the results.

2. Introduce earthworms into some of the mini-composts after it cools and compare the results to composts without earthworms. Discuss the benefits of earthworms to the soil.

3. Start a compost pile at the beginning of the school year on the school grounds. Add yard waste and/or non-meat food waste from the school cafeteria. Have students turn the pile each week during the fall and spring. Discuss your findings.

4. Invite parents to class and provide them with information on starting their own composts. Allow the students to participate in the program.

Sources:

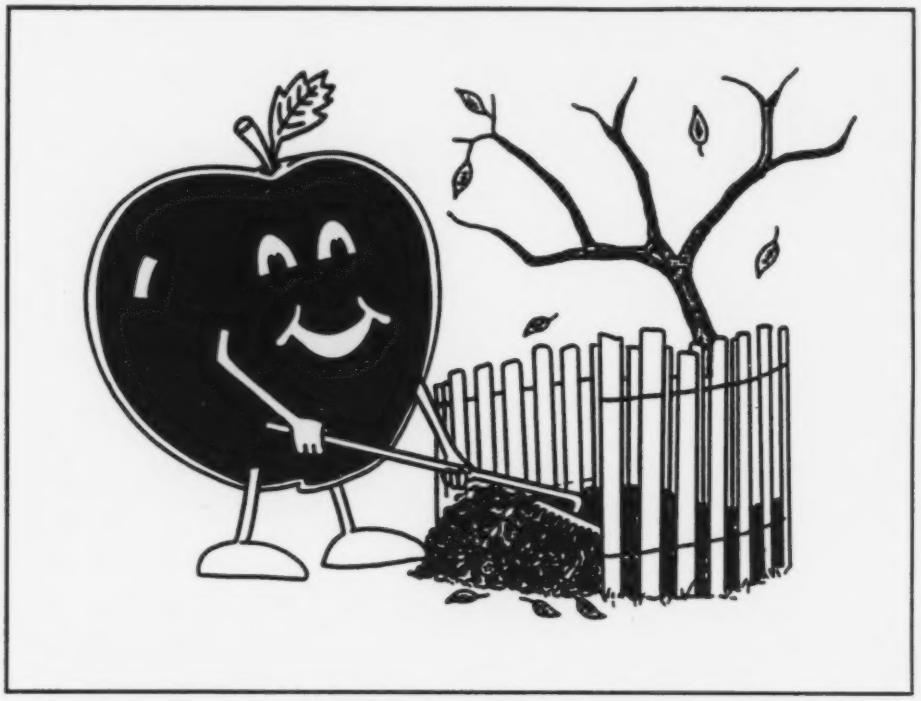
Breaking the Landfill Habit, Minnesota Pollution Control Agency, 1985.

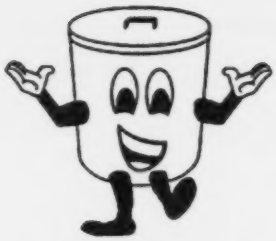
Composting, Session #8, 9th Annual Conference-Illinois Association of Recycling Centers.

Dindal, Daniel L. Ecology of Compost, State University of New York, College of Environmental Science and Forestry.

Earth Works Group. 50 Simple Things You Can Do to Save the Earth, Earthworks Press, 1989.

NOTE: BEFORE INITIATING A COMPOST HEAP ON SCHOOL PROPERTY, CHECK WITH THE SCHOOL DISTRICT AND WITH THE CITY FOR ANY ORDINANCES THAT MAY APPLY.





ACTIVITY #11
COMPOST MAGIC
DATA SHEET

DATE	COMPOST TEMP (°C)	COMPOST HEIGHT (cm)	OTHER OBSERVATIONS

AN ANNOTATED LIST OF SUPPLEMENTAL MATERIALS

* ***Available from the Illinois Department of Energy and Natural Resources' information clearinghous***

The Adventures of the Garbage Gremlin: Recycle and Combat a Life of Crime.
1990. Washington, DC: U.S. Environmental Protection Agency. *Intermediate/Middle*
A comic book approach to the problems of garbage and the recycling process. Encourages students to assess their attitudes and behaviors.

Beame, Rona. 1975. **What Happens to Garbage?**
New York, NY: Julian Mesoner, a division of Simon & Schuster. *Intermediate*
Discusses the means used by New York City to dispose of its trash and what new disposal methods are being considered.

Brackett, Karen and Rose Manley. 1990. **Beautiful Junk—Creative Classroom Uses for Recyclable Materials.**
Fearon Teacher Aids. *Primary/Intermediate*
A book of creative ideas using throwaways.

* **Directory of Illinois Recycling Centers.**
May, 1991, Springfield, IL: Illinois Department of Energy and Natural Resources.
ILENR/RR-87/03 and 87/04.
Lists Illinois recycling centers and materials they accept.

The Earth Works Group. 1990. **50 Simple Things Kids Can Do to Save the Earth.**
Kansas City, MO: Andrews & McMeel. *Primary/Intermediate*
A list of 50 simple activities that children can do to help the environment.

The Earth Works Group. 1990. **The Recycler's Handbook**
Berkeley, CA: EarthWorks Press.
A useful guide for every recycling program.

Garelick, Mary and Barb Brenner. 1979. **The Tremendous Tree Book**
New York, NY: Four Winds Press. *Primary*
Short, interesting facts about trees and fun, easy-to-do activities. Full-page illustrations are narrated by a squirrel and a raccoon.

Geisel, Theodor S. (Dr. Seuss). 1971. **The Lorax.**
New York, NY: Random House. *Primary*
An imaginary creature called the Onceler describes the results of local pollution due to lack of conservation and good ecological practices. The entire truffula tree forest is destroyed by a greedy factory owner.

James, Barbara. 1989. **Waste and Recycling.**
Austin, TX: Steck-Vaughn Library. *Intermediate*
Discusses domestic, industrial, agricultural and radioactive wastes.

* Johnson, Donna. 1991. **Recycle Our Available Resources (R.O.A.R.).**
Springfield, IL: Illinois Department of Energy and Natural Resources. *Primary/Intermediate*
Uses puppets and songs to teach students about recycling. Instructions for making puppets are provided.

Kalman, Bobbie. 1991. **Reducing, Reusing and Recycling.**
New York, NY: Crabtree Publishing Company. *Elementary/Middle*
A book with easy to understand text and illustrations of kids reducing garbage, changing wasteful habits, and taking action to create change.

* **The Land We Depend On.**
1989. Springfield, IL: Illinois Environmental Protection Agency. *Primary/Intermediate*
An activity booklet for elementary students.

Leedy, Loreen. 1991. **The Great Trash Bash.**
New York, NY: Holiday House. *Primary*
The animals of Beaston discover better ways to recycle and control their trash.

Let's Recycle: A Curriculum for Solid Waste Awareness.
1990. Washington, DC: U.S. Environmental Protection Agency. *Primary/Intermediate/Middle*
Lessons and activities about solid waste generation and management. Allows teachers to incorporate information about their communities into the activities.

* **McHenry County Schools Recycling Education Lesson Plans.**
McHenry County School District. *Primary/Intermediate*
Summary and start-up lessons on recycling solid waste.

Nelson, JoAnne. 1990. **Don't Throw It Away!**
Cleveland, OH: Modern Curriculum Press. *Primary*
A short story about using throwaways and how recycling can help improve the solid waste crisis. Nice illustrations.

Palmer, Joy. 1990. **Recycling Plastic.**
1990. New York, NY: Franklin Watts. *Intermediate*
Discusses problems with plastic product manufacture and disposal and shows how recycling can reduce the environmental problems.

Perrins, Leslie. 1985. **How Paper Is Made.**
New York, NY: Threshold Books Limited. *Intermediate/Middle*
Informative text and illustrations on how paper is made.

* Peters, Thomas J. and Janet L. Wissman. 1991. **Actions Speak!**
Springfield, IL: Illinois Department of Energy and Natural Resources. *Intermediate/Middle*
Although this guide was written for the middle school student, the idea of role-playing to clarify issues in solid waste also can be relevant to younger children.

* **Reduce, Reuse, Recycle: It's Elementary**.
1990. Springfield, IL: Illinois Department of Energy and Natural Resources.
Primary/Intermediate/Middle
A video for elementary and middle-level students that illustrates the solid waste problem and solutions students can practice in school.

Ride the Wave of the Future: Recycle Today!
1990. Washington, DC: U.S. Environmental Protection Agency. *Primary/Intermediate/Middle*
Colorful poster promoting recycling that is suitable for all ages.

* **The Rotten Truth**.
New York, NY: Children's Television Network. *Elementary/Middle*
A video narrated by and designed for elementary/middle-level students on solid waste problems and solutions.

Rockwell, Harlow. 1974. **The Compost Heap**.
Garden City, NY: Doubleday & Co., Inc. *Primary*
Explains in simple terms how a compost heap is made and how it turns into soil.

School Recycling Programs: A Handbook for Educators.
Washington, DC: U.S. Environmental Protection Agency. *Primary/Intermediate/Middle*
Describes several school recycling program options and provides step-by-step instructions for setting up a program.

Simon, Robin. 1976. **Recyclopedia: Games, Science Equipment and Crafts from Recycled Materials**.
Boston, MA: Houghton-Mifflin Co. *Primary/Intermediate*
A book showing how to create exciting new things from inexpensive, readily available objects we tend to ignore. Even 20 years later, this book is still appropriate. Activities for K-5.

* **Solid Waste Activity Packet for Teachers**.
1991. Springfield, IL: Illinois Department of Energy and Natural Resources.
Primary/Intermediate/Middle
Includes activities on recycling, reduction, and reuse of materials.

* **The Three R's**.
Springfield, IL: Illinois Department of Energy and Natural Resources.
Primary/Intermediate/Middle
A newsletter published by ENR that features articles, activities and information on solid waste topics. Call the ENR information clearinghouse to be placed on the mailing list.

* Treptow, Richard S. 1991. **Solid Waste Videos: A Teacher's Guide to Selected Videotapes on Solid Waste Management**.
Springfield, IL: Illinois Department of Energy and Natural Resources. *Primary/Intermediate*
Includes summaries, discussion questions, and activities on videos for grades K-12.

Tusa, Tricia. 1988. **Stay Away from the Junk Yard.**
New York, NY: Collier-MacMillan. *Intermediate*
A book that warns about the dangers of throwing potentially toxic substances into the trash.

Van Allsburg, Chris. 1990. **Just a Dream.** Boston, MA: Houghton-Mifflin Co.
Primary/Intermediate
Follows a child's dream of a world that recycles and reuses trash instead of filling up its landfills.

*** Waste Reduction Guide for Illinois Schools.**
1990. Springfield, IL: Illinois Department of Energy and Natural Resources. *Elementary/Middle*
A simple 10-step guide to starting a recycling program in your school.

Werenko, Lisa. 1988. **It Zwibble and the Greatest Cleanup Ever!**
New York, NY: Scholastic Inc. *Primary*
A clever, colorful book featuring "It Zwibbles," dinosaur-like creatures whose plans for a picnic are interrupted by a messy landscape. Follow their cleanup adventures.

*** The Wonderful World of Recycling.**
Denver, CO: Recycle Now. *Primary*
A video for primary grades on what can be recycled and how new products can be made from recycled materials.

TO ORDER SOLID WASTE MATERIALS OR FOR MORE INFORMATION, CONTACT:

Illinois Department of Energy and Natural Resources
Information Clearinghouse
325 W Adams Street, Room 300
Springfield, IL 62704-1892

Phone Number:

(800) 252-8955 (IL only)
(217) 785-0310

GLOSSARY

bacteria	microscopic single-celled organisms. They are decomposers that convert organic waste into usable products and are active in composts.
biodegradable	able to be broken down by living organisms into natural substances such as carbon dioxide and water.
composting	the natural conversion of most organic materials to humus by microorganism activity.
decomposition	the break down of organic materials into basic compounds that can be used to improve the soil; rot.
fertilizer	material added to soil to enrich or improve it.
groundwater	water below the ground's surface.
landfill	a system of garbage disposal where wastes are buried.
methane	a colorless, odorless, flammable gas formed by plant decomposition.
natural resources	naturally occurring materials such as plants, animals, soil, minerals, water, and air.
open dump	site where wastes are dumped and left uncovered with little regard for control of pollution, diseases, or scavengers.
organic waste	any waste that was once a living organism or the product of a living organism. Organic wastes can be made into a compost.
packaging	the covering or wrapping material of items. Packaging may be natural or man-made. Excessive or nonrecyclable packaging contributes to the solid waste problem.
plastic	materials derived from petroleum that are increasingly used as substitutes for glass, metal, wood, and paper.
polystyrene	a type of plastic. One type of polystyrene is used in packing and insulation materials, food trays, egg cartons, fastfood containers, and hot cups. Polystyrene foam is commonly known as styrofoam.
pulp	a mixture of plant fibers and water used to make paper.
raw materials	materials that are not manufactured.
recycle	to collect, process, and market materials so that they can be used again.
reduce	to decrease the amount of waste that is thrown away and enters the waste stream.
reuse	to use items again and prevent them from becoming trash. An example of reuse is refilling returnable soft drink bottles.
solid waste	all materials discarded as trash and handled as solids, as opposed to those that are flushed down sewers and handled as liquids.

STATE GOALS FOR LEARNING

BIOLOGICAL AND PHYSICAL SCIENCES

STATE GOAL FOR LEARNING I

As a result of their schooling, students will have a working knowledge of the concepts and basic vocabulary of biological, physical, and environmental sciences and their application to life and work in contemporary technological society.

GENERAL KNOWLEDGE/SKILLS RELATED TO GOAL 1

The following knowledge and skills are related to this State Goal for Learning:

A Symmetries or patterns in the natural and physical world.

B Orderliness in nature and the schemes we use to express this order.

C Fundamental units used to express the structure of nature.

D How two or more things interact and the effect each has on the other.

E Common characteristics of plant and animal communities.

F Characteristics of energy and matter.

G Equilibrium applied to simple systems.

H Influence of a field on objects within its domain.

I Cause and effect relationships which allow predictions to be made.

J Cycles in which conditions or events are repeated at regular intervals.

K Systems as defined by boundaries.

L Stages, mechanisms, and rates of change.

M Organism as a system which can be characterized by the processes of life.

N Relationship of structure to function.

O The nature of force.

P Perception as our way of interpreting the world.

Q Time and space as dimensions which separate things and events.

STATE GOAL FOR LEARNING 2

As a result of their schooling, students will have a working knowledge of the social and environmental implications and limitation of technological development.

GENERAL KNOWLEDGE/SKILLS RELATED TO GOAL 2

The following knowledge and skills are related to this State Goal for Learning:

A Relationships between science and technology.

B Selected nonrenewable and renewable natural resources.

C Relationships between the natural and technological world.

D Influence of scientific and technological research on the needs, interest, and financial support of society.

E Application of scientific research to consumer decision making.

F Application of selected ecological concepts to human and environmental situations.

G Society's responsibility for improving the environment and protecting natural resources.

H Environmental issues in light of scientific and technological knowledge and ethical principles.

STATE GOAL FOR LEARNING 3

As a result of their schooling, students will have a working knowledge of the principles of scientific research and their application in simple research projects.

GENERAL KNOWLEDGE/SKILLS RELATED TO GOAL 3

The following knowledge and skills are related to this State Goal for Learning:

A Ethical Practices which include:

1. Honesty and integrity in the recording and reporting of the results of scientific inquiry;
2. Disclosure, including open discussion of ideas, techniques and results;
3. Rights of subjects, humanness and respect for life.

B Basic scientific standards and research abilities which include:

1. Accuracy, skill and safe practices in laboratory activities;
2. Application of an operational definition using terms to physically describe the activity or result of a procedur
3. Good experimental techniques which will be evident by the precision practiced during the investigation;
4. Systematization of data to maintain an orderly manner of review;
5. Effectiveness in communicating laboratory procedures and results;
6. Ability to analyze, evaluate or replicate the experimental work of others.

STATE GOAL FOR LEARNING 4

As a result of their schooling, students will have a working knowledge of the processes, techniques, methods, equipment and available technology of science.

GENERAL KNOWLEDGE/SKILLS RELATED TO GOAL 4

The following knowledge and skills are related to this State Goal for Learning:

A Observation.

B Classification.

C Inference.

D Prediction.

E Measurement.

F Communication.

G Data collection, organization and interpretation.

H Operational definition development.

I Question and hypothesis formulation.

J Experimentation.

K Model formulation.

L Results verification.

M Scientific equipment use.

STATE GOALS FOR LEARNING

MATHEMATICS

STATE GOAL FOR LEARNING 1

As a result of their schooling, students will be able to perform the computations of addition, subtraction, multiplication, and division using whole numbers, integers, fractions, and decimals.

Computational skills prepare a student to use the symbols of the number system, the concepts, the processes, and the goals of mathematics (calculators, computers, etc.) to solve problems in real-life situations. These skills also provide a basis for further study in mathematics. Students should be able to perform some skills MENTALLY, do some with PAPER AND PENCIL, and do some using the appropriate TECHNOLOGY.

GENERAL KNOWLEDGE/SKILLS RELATED TO GOAL 1

The following knowledge, processes, and skills are related to this State Goal for Learning:

A Ability to read, write and name numbers in several different ways.

B Ability to perform operations with numbers with and without a calculator.

C Ability to translate word problem situations to mathematical expressions or sentences and solve the sentence

D Ordering numbers.

E Application of properties of numbers and operations.

F Use of exponents, powers, and roots.

G Use of factors and multiples.

H Application of computational and problem-solving skills to common life situations with or without calculators.

I Use of number patterns.

STATE GOAL FOR LEARNING 2

As a result of their schooling, students will be able to understand and use ratios and percentages.

Ratios, proportions, and percents are means for comparing and analyzing quantitative relationships. Practicing these techniques with real-life situations will hasten routine use.

GENERAL KNOWLEDGE SKILLS/RELATED TO GOAL 2

The following knowledge, processes, and skills are related to this State Goal for Learning:

A Interpretation of ratios.

B Construction and solution of proportions.

C Application of ratios and proportions to real-life situations.

D Interpretation of percents in various settings.

E Application of percents in real-life situations.

STATE GOAL FOR LEARNING 3

As a result of their schooling, students will be able to make and use measurements, including those of area and volume.

Measurement is the process of systematically associating numbers with objects and actions. Familiarity with common systems (metric and customary) and instruments of measurement is basic to an understanding of our world.

GENERAL KNOWLEDGE/SKILLS RELATED TO GOAL 3

The following knowledge, processes, and skills are related to this State Goal for Learning:

A Measurement in various contexts using appropriate units.

B Estimation of measurements.

C Relating lengths, areas, and volumes in common geometric figures.

D Conversion of units within one system and from one system to another.

E Application of selected measurement systems, instruments, and techniques.

STATE GOALS FOR LEARNING

SOCIAL SCIENCES

STATE GOAL FOR LEARNING 1

As a result of their schooling, students will be able to understand and analyze comparative political and economic systems, with an emphasis on the political and economic systems of the United States.

GENERAL KNOWLEDGE/SKILLS RELATED TO GOAL 1

The following knowledge and skills are related to this State Goal for Learning:

A Basic prinicipies of American government as expressed or implied in the Declaration of Independence, the federal and state constitutions, other major historical documents, and significant court decisions.

B Rights and responsibilities of citizenship under the United States Constitution.

C Election processes at all levels of government, including the impact of communication systems.

D Structures and functions of the political systems in the United States and Illinois.

E Influences of political action by individuals and interest groups on the development of the American political system.

F Factors that have contributed to the economic development of the United States.

G Economic interdependence among the Illinois, United States, and world communities.

H Economic impacts of political decisions made by federal, state and local governments.

I Structures and functions of major political systems in the world.

J Major political events in the contemporary world and their impact on the changing structures and functions of governments.

K International organizations like the United Nations and their roles and functions in the modern world.

L Evolution and nature of rules and laws that govern human interactions.

M Basic economic concepts that have traditionally shaped economic systems.

N Traditional, market, and command economic systems.

O Effects of basic economic principles on producers and consumers in the public and private sectors.

STATE GOAL FOR LEARNING 2

As a result of their schooling, students will be able to understand an analyze events, trends, personalities and movements shaping the history of the world, the United States and Illinois.

GENERAL KNOWLEDGE/SKILLS RELATED TO GOAL 2

The following knowledge and skills are related to this State Goal for Learning:

A Chronology and significance of the major events in world history.

B Historical developments leading to the present similarities and differences among the world's people.

C Contributions of significant men and women in world history.

D Chronology and significance of the major social, economic and political events shaping the American experience.

E Historical relationships between the United States and the other nations of the world.

F Impacts of urbanization, industrialization and emerging technology on the nation's environment, as well as on its social, political and economic institutions.

G Roles played by racial and ethnic groups in developing the nation's pluralistic society.

H Historical and contemporary relationships of Illinois to the United States and the rest of the world.

STATE GOAL FOR LEARNING 3

As a result of their schooling, students will be able to demonstrate a knowledge of the basic concepts of the social sciences and how these help to interpret human behavior.

GENERAL KNOWLEDGE/SKILLS RELATED TO GOAL 3

The following knowledge and skills are related to this State Goal for Learning:

A Selected theories of human physical development.

B Selected principles of learning and motivation.

C Selected relationships between personality and development.

D Development and functions of the institution of the family.

E Common support networks in contemporary society.

F Development of oral and written communication.

G Selected types of antisocial behavior and various methods of intervention.

H Influences of customs, traditions, and folkways in shaping human behavior.

I Effects of mass communication on human behavior.

STATE GOAL FOR LEARNING 4

As a result of their schooling, students will be able to demonstrate a knowledge of world geography with emphasis on the United States.

GENERAL KNOWLEDGE/SKILLS RELATED TO GOAL 4

The following knowledge and skills are related to this State Goal for Learning:

Location: Position on the Earth's Surface

A Location of physical and cultural features of the local community, the state, the nation and the world.

B Use of maps and models as primary geographic tools.

C Influences of physical and cultural features on the locations of objects and places.

Place: Physical and Human Characteristics

D Ways in which people define, name and alter places.

E Different ways in which various groups within society may view places.

F Positive and negative effects of human actions or natural processes on places.

Relationships within Places: Humans and Environments

G Ways people inhabit, modify and adapt culturally to different physical environments.

H Habitats as complex ecosystems which may have been modified by human action.

I Ways people depend on, evaluate, and use natural environments to extract needed resources, grow crops and develop settlements.

Movements: Humans Interacting on the Earth

J Ways people depend on products, information, and ideas that come from beyond their immediate environment.

K Ways people move themselves, their products, and their ideas across the earth's surface.

L Concept or region in physical and cultural terms.

M Cultural and physical geography of each of the world's regions.

N Basic physical and cultural geography of the United States.

STATE GOAL FOR LEARNING 5

As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations.

GENERAL KNOWLEDGE/SKILLS RELATED TO GOAL 5

The following knowledge and skills are related to this State Goal for Learning:

A Rational decision-making processes based on goals, values, and needs applied to selected consumer and social problems.

B Sources of information evaluated in terms of selective criteria.

C Costs and benefits of a particular course of action.

D Interdependent roles of an individual as a consumer, a producer, and a citizen in the United States economic/ political/social system.

E Various relationships between the individual and others in the local community, state, nation and world.

F Citizen's role in the election process at the local, state, and national levels.

G Ways to utilize the various levels of government.

H Roles of individuals and/or groups in effecting change.

I Roles of the individual in the world of work.

J Relationships between competence and potential.

K Relationships between individual and societal value systems.

L Strategies for conflict resolution evaluated in terms of selected criteria.

M Management of human and material resources.